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U.S. Progress in Implementing The Great Lakes Water Quality Agreement

Annex Reports to the International Joint Commission

1988

Minnesota
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16. ABSTRACT

This is the first Report to the International Joint Commission on Annexes 1, 2, 12, 14, 15 and 16 to the Great Lakes Water Quality Agreement as one of the Parties signatory to that Agreement. As a progress report. It is linked in function to the 1988 Report to Congress by the USEPA, and to the Canadian Report to the IJC.

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Annex Reports to the International Joint Commission

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INTRODUCTION

The 1987 revisions to the Great Lakes Water Quality Agreement (GLWQA) strengthened many of the Agreement's provisions, including clarification of the responsibilities of the United States and Canada as Parties to the Agreement. One significant revision requires that the Parties report on progress in addressing Annexes 1, 2, 12, 13, 14, 15 and 16. In response, this document was prepared as the first Report to the International Joint Commission (IJC) on U.S. progress towards responding to these Annexes.

In addition to the specific reporting requirements to which this document responds, Article IX of the GLWQA states that "the IJC shall be given, at its request, any data or information relating to water quality in the Great Lakes system...." Such information is used extensively in preparing the reports of the Water Quality Board to the Commission. One very important category of this information relates to point sources of pollution and progress towards its control. Therefore, a special section has been included at the end of this Report to provide current information on U.S. programs for the control of point sources.

U.S. programs and activities that address provisions of the GLWQA not covered in this report are discussed in the 1988 Report to Congress on the Great Lakes Water Quality Agreement and in the Five-Year Strategy for the Great Lakes National Program Office. Readers desiring copies of those documents should contact the Great Lakes Program Office, 230 South Dearborn Street, Chicago, Illinois 60604. Further information on U.S. and Canadian activities related to the GLWQA can be found in the Great Lakes Water Quality Board Report to the IJC, available from the Windsor Regional Office of the IJC, Post Office Box 32869, Detroit, Michigan 48232.

ANNEX 1: SPECIFIC OBJECTIVES

Annex 1 and its 1987 Supplement call for the development of Specific Objectives, which are defined in the GLWQA as "the concentration or quantity of a substance or level of effect that the Parties agree, after investigation, to recognize as a maximum or minimum desired limit for a defined body of water or portion thereof, taking into account the beneficial uses or level of environmental quality which the Parties desire to secure and protect;..."

In addition to the existing Objectives categories in the GLWQA -- Chemical, Physical, Microbiological and Radiological -- the Supplement added Ecosystem Objectives, to emphasize the aspect of "level of effect" in the above definition. Achievement of Ecosystem Objectives is to be evaluated through ecosystem health indicators, which will be developed as described in Annex 11.

The Supplement to Annex 1 modifies the Annex by clarifying responsibility and establishing a framework for developing Specific Objectives. To assist in sorting out the many chemicals that could be considered in this task, the Supplement requires the development of three lists of substances believed to have toxic effects and found within the Great Lakes System, or having potential for discharge into it. In proposing substances for new Specific Objectives, the Parties are to be guided by these lists.

Although no new Objectives have been added, important work on identifying and characterizing substances found within the Great Lakes was done by IJC committees. Of the approximately 1,000 compounds reported to have been found, the committees confirmed the presence of 264, as reported in the 1987 Water Quality Board Report. The 1987 revisions to the GLWQA shifted the responsibility for such work from the IJC to the Parties. In response, the United States and Canada formed an Objectives Development Committee and began the process to developing lists of compounds and reviewing extant and prospective Objectives.

Although implementing this new responsibility has progressed somewhat slowly, progress is being made. The effort will be supported in part by the well-established United States process for developing regulatory criteria and standards for ambient conditions that are analogous to Specific Objectives. In the November 1988 semi-annual meeting of the Parties, initial agreement was reached on definitions to be used in creating the three substance lists, and a preliminary list was derived for substances that are toxic and present in the Lakes (List 1). Also, initial agreement was reached on a new Specific Objective for dioxin, and on revisions in the Objectives for selenium and toxaphene. These objectives will not be officially adopted until public consultation occurs and official communication is completed between the U.S. Department of State and External Affairs Canada.

Efforts by the Parties to develop definitions, lists and objectives will continue. This work will be reviewed regularly in the semi-annual meetings of the Parties. Considerable progress is expected before the next formal report on the development of objectives is due, in December 1990.

ANNEX 2: REMEDIAL ACTION PLANS AND LAKEWIDE MANAGEMENT PLANS

INTRODUCTION

The basic management framework of the GLWQA defines environmental quality objectives and beneficial uses, requires monitoring the state of the Lakes and pollutant inputs, and outlines management plans to identify the remedial actions needed to attain the desired objectives and beneficial uses. Nonattainment of Agreement objectives is addressed on three geographic scales: Lakewide Management Plans (LMPs) will address critical pollutants that are impairing beneficial uses in waters of the open Lakes, Remedial Action Plans (RAPs) will address use impairments within designated Areas of Concern (AOCs), and Point Source Impact Zones adjacent to discharge points will be identified and minimized.

Annex 2 of the amended GLWQA endorses and builds upon the existing efforts of the Parties, States, Provincial governments, and the International Joint Commission (IJC) to develop RAPs and LMPs. The major provisions of Annex 2 include specifications for the content of RAPs and LMPs, and requirements for designating critical pollutants for the boundary waters of the Great Lakes System with regards to LMPs. The Annex also introduces the concept of Point Source Impact Zones, defining them as zones that "...exist in the vicinity of some point source discharges," the size of which "...shall be reduced to the maximum extent possible by the best available technology." Methods for identifying and delineating point source impact zones will be developed and progress must be reported beginning September 30, 1989, and reviewed biennially thereafter (Annex 2, Section 7).

The Annex also requires that the Parties report to the IJC by December 31, 1988, and biennially thereafter, on their progress in developing and implementing RAPs and LMPs, and in restoring beneficial uses to the Great Lakes System.

REMEDIAL ACTION PLANS

RAPs are the result of a process that began in 1981 when the Great Lakes Water Quality Board identified a number of geographic areas within the Great Lakes Basin (subsequently called Areas of Concern) that had severe water quality problems. These areas were seriously out of compliance with Agreement objectives or jurisdictional standards, criteria, or guidelines established to protect beneficial uses. The present 42 AOCs include Lake areas adjacent to most of the major metropolitan and industrial centers within the Basin (Figure 1). Of the total number of AOCs, 41 suffer from toxic substances contamination. Most of these have problems related to contaminated bottom sediments.

Responsible Parties

Thirty AOCs are located wholly or in part within the United States. The States have taken responsibility for developing RAPs with assistance from various Federal agencies, including the U.S. Environmental Protection Agency's (USEPA's) Great Lakes National Program Office (GLNPO), U.S. Army Corps of Engineers (USCOE), U.S. Fish and Wildlife Service (USFWS), U.S. Department of Agriculture, and U.S. Geological Survey (USGS). Table 1 presents a summary of the States responsible for RAP development and the completion status of U.S. RAPs.

Illinois and Indiana are both responsible for one AOC. The Illinois EPA is coordinating efforts on the Waukegan Harbor AOC, and the Indiana Department of Environmental Management is developing a RAP for the Grand Calumet River/Indiana Harbor AOC.

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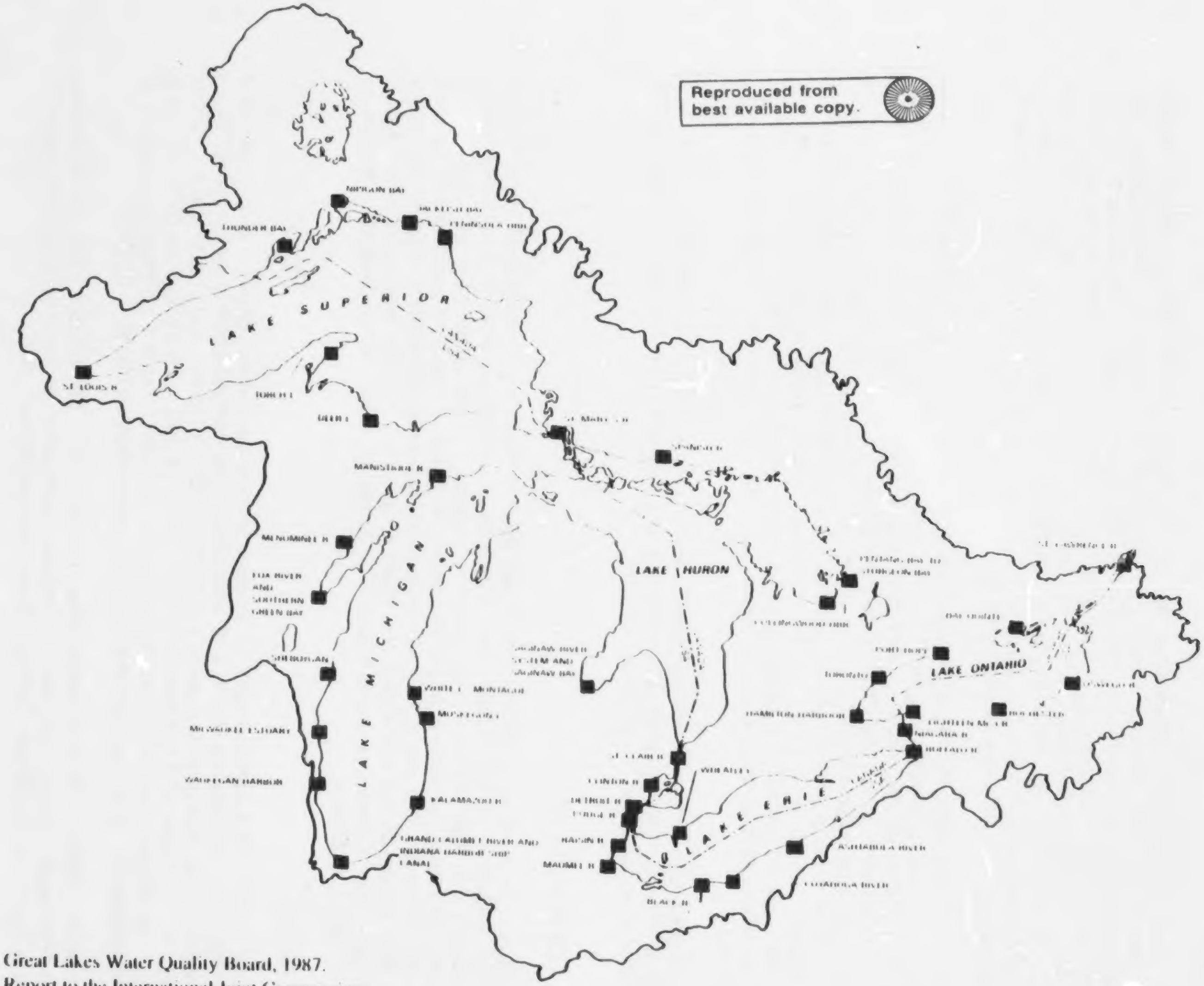
NIPIGON BAY
THUNDER BAY
JACKFISH BAY
PENINSULA HBR
LAKE SUPERIOR
ST LOUIS R
TORCH L
DEER L
ST MARYS R
SPANISH R
MANISTIQUE R
MENOMINEE R
FOX RIVER AND SOUTHERN GREEN BAY
SHEBOYGAN
MILWAUKEE ESTUARY
WAUKEGAN HARBOR
LAKE MICHIGAN
WHITE L MONTAGUE
MUSKEGON L
KALAMAZOO R
GRAND CALUMET RIVER AND INDIANA HARBOR SHIP CANAL
SAGINAW RIVER SYSTEM AND SAGINAW BAY
LAKE HURON
PENETANG BAY TO STURGEON BAY
COLLINGWOOD HBR
ST CLAIR R
CLINTON R
DETROIT R
ROUGE R
RAISIN R
MAUMEE R
BLACK R
WHEATLEY
LAKE ERIE
ASHTABULA RIVER
CUYAHOGA RIVER
HAMILTON HARBOUR
TORONTO
PORT HOPE
BAY OF QUINTE
LAKE ONTARIO
EIGHTEEN MILE CR
NIAGARA R
BUFFALO R
ROCHESTER
OSWEGO
ST LAWRENCE R

Source: Great Lakes Water Quality Board, 1987.
Report to the International Joint Commission,
Windsor, Ontario, and Detroit, Michigan, p. 38

Figure 1. Location of Areas of Concern in the Great Lakes

TABLE 1. STATUS OF U.S. REMEDIAL ACTION PLANS

Areas of Concern by State	Projected Date to Submit Completed RAPs for IJC Review
Illinois	
Waukegan Harbor	Deferred
Indiana	
Grand Calumet/ Indiana Harbor	1989
Michigan	
Torch Lake	1987
Deer Lake/Carp River	1987
Manistique River	1987
Kalamazoo River	Pending Civil Litigation
Muskegon Lake	1987
White Lake	1987
Saginaw River/ Saginaw Bay	1988
Clinton River	1988
Rouge River	1988
River Raisin	1987
Michigan/Ontario	
St. Marys River	1989
St. Clair River	1989
Detroit River	1989
Minnesota/Wisconsin	
St. Louis River	1990
New York	
Buffalo River	1989
Eighteenmile Creek	1990
Rochester Embayment	1990
Oswego River	1989
New York/Ontario	
St. Lawrence River	1990
Niagara River	1991

TABLE 1. STATUS OF U.S. REMEDIAL ACTION PLANS
(continued)

Areas of Concern by State	Projected Date to Submit Completed RAPs for IJC Review
Ohio	
Maumee River	1989
Black River	1990
Cuyahoga River	1991
Ashtabula River	1989
Wisconsin/Michigan	
Menominee River	1989
Wisconsin	
Fox River/ Southern Green Bay	1987
Sheboygan Harbor	1989
Milwaukee Estuary	1990

Wisconsin contains three AOCs in their entirety and shares two others: One with Minnesota and one with Michigan. The Wisconsin Department of Natural Resources is responsible for coordinating RAP efforts. The State uses the Clean Water Act, Section 208 Water Quality Management Plans (WQMPs) as a management tool for statewide prioritization. The State is currently updating the WQMP for the Lake Superior Basin and will incorporate their findings into the St. Louis River RAP that Wisconsin is developing in cooperation with Minnesota.

Michigan has ten AOCs within its boundaries and, in addition, shares one AOC with Wisconsin and three with Ontario. The Michigan Department of Natural Resources is responsible for developing and/or coordinating RAP initiatives. Michigan has several other statewide initiatives related to the restoration of beneficial uses called for in Annex 2. For example, Michigan voters recently supported a $425 billion bond issue to fund environmental protection programs. This fund will finance the cleanup of toxic waste sites and other contaminated areas, contribute to a regional Great Lakes protection fund, address solid waste problems, treat sewage and other water quality problems, encourage reuse of industrial sites, and preserve open space.

Four AOCs are located in Ohio. The Ohio EPA is preparing the RAPs in cooperation with various citizen advisory committees.

There are four AOCs located within New York's boundaries and two that New York shares with Ontario. All of New York's RAP development and coordination and cooperation initiatives are managed through the New York State Department of Environmental Conservation.

The following is a Lake-by-Lake discussion of the AOCs and the progress that has been made on the RAPs since the IJC's 1987 Report on Water Quality.

Lake Superior

Lake Superior, is the largest (82,100 km^2)and the deepest (maximum depth of 407 m and mean depth of 149 m) of the Lakes, and has remained the most pristine and oligotrophic system. Concentrations of polychlorinated biphenyls (PCBs) in lake trout in Lake Superior continue to exceed the Agreement objective, while the DDT, dieldrin, and mercury objectives are being met. Public health fish consumption advisories have been issued for lake trout taken from Lake Superior waters.

The Water Quality Board has identified seven AOCs in Lake Superior where GLWQA objectives are not being met. The following three AOCs are located within the United States.

St. Louis River/Bay

The St. Louis River/Bay AOC is located on the extreme southwest shore of Lake Superior. The lower part of the river acts as the border between Minnesota and Wisconsin. Most of the river's watershed is in Minnesota. The AOC includes the St. Louis Bay, Superior Bay, Allouez Bay, the nearshore waters of Lake Superior and the St. Louis River below the Fond du Lac dam.

Historically, water quality has been affected primarily by discharges from local industrial and municipal sources. Although water clarity above the zone of dischargers is fairly good, the water is stained slightly brown because of high content of humic acids and naturally occurring related compounds. Current water quality data generally show no significant problems, although past data have indicated elevated levels of mercury at some stations. High levels of PCBs, dioxin, and mercury have also been found in northern pike, walleye, and carp tissue samples.

The RAP for this AOC is being written by both Minnesota and Wisconsin. Minnesota's Pollution Control Agency has accepted the lead role for this RAP, and Wisconsin is providing technical assistance and review. A RAP Coordinator was hired in June 1988, and initiation of the

RAP development process has begun. Two public meetings were held in November, and a survey of meeting participants' concerns and ideas has been completed. A Citizen's Advisory Committee will be established in January 1989, and soon after, technical advisory committees will be established for each issue area. The RAP will identify the beneficial uses impaired, data gaps, and remedial actions to restore the beneficial uses. Completion of the RAP is scheduled for June 30, 1989.

Torch Lake

Torch Lake, located at the base of the Keweenaw Peninsula in the Upper Peninsula of Michigan, is a tributary to Lake Superior. Degradation has been caused by mine tailings disposed of in the Lake and sediments contaminated with creosotes and xanthates that were used in a copper-concentrating process from 1926 to 1969. These substances are thought to have caused a high incidence of liver tumors and other malignant deformities in older, larger walleye and sauger fish. In recent years, the incidence of tumors seems to have decreased, however; fish of the affected size class can no longer be found.

The Michigan Department of Natural Resources submitted a first draft of the Torch Lake RAP in October 1987 and received comments from IJC in June 1988. Those comments are currently being addressed. Most of the possible remedial actions have already been taken. No effective method for sediment removal has been developed and remedial action will entail allowing sediments from upstream to cover the copper-contaminated sediment layer.

Deer Lake/Carp Creek/Carp River

The Deer Lake/Carp Creek/Carp River AOC includes Deer Lake, Carp Creek, and 20 miles of the Carp River downstream to Marquette, Michigan, on Lake Superior. Deer Lake is a 907-acre impoundment located near Ishpeming in Michigan's Upper Peninsula. In 1981, mercury was found at high concentrations in fish, sediments, and fish-eating birds. A fish consumption advisory has been in effect since 1981.

The RAP for Deer Lake was submitted in October 1987. In 1988, extensive fish monitoring was conducted; fish were collected and their tissues analyzed for mercury content.

St. Marys River

The St. Marys River is one of the four Great Lakes connecting channels. The river flows approximately 110 km from Lake Superior to Lake Huron. The United States and Canada share responsibility for developing remedial actions for the St. Marys River. Degradation of water quality can be attributed to power generation, shipping traffic, and discharges of nutrients and toxic substances from industrial and municipal point sources, as well as urban nonpoint source discharges and combined sewer overflows. In particular, sediments are contaminated with iron, zinc, cyanide, oils and greases, phenols, and wood particles, while the water column has elevated concentrations of phenols, iron, zinc, cyanide, and ammonia.

Completion of the St. Marys River RAP has been delayed until September 1990 to allow completion of the Upper Great Lakes Connecting Channels (UGLCC) Study. The study will provide the region with new data that will be incorporated into the RAP. The Cannelton Tannery has been designated as a Superfund site by USEPA. No new site specific studies or remedial actions have been undertaken since 1987. The site has a Binational Public Advisory Council that contributes to RAP development efforts.

Lake Michigan

Lake Michigan lies completely within the United States, and is the second largest Lake in terms of volume and depth, but the third in terms of surface area (57,800 km^2). PCB and DDT concentrations are gradually declining in Lake Michigan lake trout, but still remain above the Agreement objectives. Public health fish consumption advisories have been issued for lake trout, salmon, and brown trout taken from Lake Michigan waters.

There are ten AOCs on Lake Michigan. A brief discussion of each AOC and the status of RAP development follows.

Manistique River

The Manistique River is located in Michigan's central upper peninsula and flows from the northeast, discharging into Lake Michigan at Manistique City. Impacts to biota were first noted in the mid-1950s and were attributed primarily to deposits of wood fiber and other organic waste from sawmill and papermill operations and to sanitary wastes. Later studies also identified several chemical wastes that contributed to degradation. Environmental degradation at this site is primarily sediment contaminated with PCBs and heavy metals, which adversely impacts biota and causes fish consumption advisories.

The Michigan DNR submitted a draft RAP in October 1987, received comments from the IJC, and is revising the RAP accordingly. In addition, several studies have been conducted in the past year to test for additional sources of contamination. Specifically, fish have been collected from above the Manistique dam (outside the AOC). In summer 1988, fish tissue was tested primarily for the presence of PCBs. The results were not available as of February 1989. Sediment samples have also been collected from within the AOC and from above the dam to test for and compare contaminant levels to State and Federal criteria.

Menominee River

The Menominee River AOC is shared by the States of Wisconsin and Michigan. It acts as Wisconsin's northeastern corner border and flows between Menominee, Michigan, and Marinette, Wisconsin, emptying into Sturgeon Bay, Lake Michigan. The river generally receives heavy recreational use. In addition, lake sturgeon use the area for spawning and there is an extensive walleye fishing industry located at this site. The primary concern here is the presence of arsenic in the sediments of the Marinette Harbor. In addition, PCBs have been detected in area fish, and local beaches have been closed occasionally due to high counts of fecal coliform bacteria.

Officials plan to submit a RAP for this area in 1989. A Citizens Advisory Committee was established in early 1988. The Committee's role is to develop community support and review recommendations. A technical work group is also being established and will hold its first meeting in November 1989. The RAP will be developed in conjunction with a Consent Order between the USEPA and the Ansul Fire Protection Company, which is being held responsible for discharges of arsenic to the local publicly owned treatment works. More detailed information is confidential to date and further RAP development is dependent upon disclosure. Wisconsin has the lead role in this joint endeavor with Michigan and will hire a full-time RAP coordinator when funds become available.

Fox River/Southern Green Bay

The Fox River/Southern Green Bay AOC is located in northeastern Wisconsin near the west shore of Lake Michigan. The AOC includes the City of Green Bay, the lower 7 miles of the Fox River, and the southern end of Green Bay, extending north to an imaginary line from Long Tail Point to Point au Sable (approximately 20 square miles). Although there have been marked improvements in the water quality and fisheries in this AOC, major problems still exist regarding toxic contaminants, excess nutrients and turbidity, and habitat loss. Over 100 toxic substances, including 37 priority pollutants and 11 different resin and fatty acids, were identified in the discharges to the Lower Fox River from 14 pulp and paper mills and five major municipal wastewater treatment plants.

The first draft of the Fox River/Southern Green Bay RAP was submitted in 1987. The Wisconsin Department of Natural Resources (DNR) has received comments from the IJC on the first draft and will address these concerns in a letter to the IJC. The RAP has also been submitted to the Secretary of the DNR as part of a statewide water quality management plan. The RAP is now being implemented, and an implementation coordinating committee has been established. This committee is chaired by a county executive, ensuring that local citizens will be involved with the RAP process. The committee acts as an advisory council to the DNR and is divided into two subcommittees: a nonpoint source subcommittee and a public education and participation subcommittee.

In support of the RAP, the Wisconsin DNR and the USEPA are coordinating the Green Bay Mass Balance Study. Wisconsin is conducting numerous studies on the Fox River that will contribute data to the mass balance modeling effort. The State is also developing a detailed program for cleaning up the East River, which is a State-designated priority watershed. This includes Best Management Practice development and a cost-sharing plan to aid local counties in nonpoint source pollution cleanup. In addition, the Green Bay Municipal Sewerage District is upgrading its system to meet current effluent limits.

Lower Sheboygan River and Harbor

The Lower Sheboygan River and Harbor AOC includes the entire Sheboygan Harbor and approximately 12 miles of the river from its mouth to Sheboygan Falls. Problems include PCB-contaminated fish and sediments resulting in a fish consumption advisory, high bacteria levels, excess sediment and turbidity, and a poor quality community of aquatic organisms as indicated by an overabundance of pollution tolerant insects and algae.

The Sheboygan River Task Force and the Citizens Advisory Committee are cooperating with the Wisconsin DNR to develop the RAP for this site. Currently, a definition of the problem has been distributed for public comment, and recommendations for corrective action are being drafted. A draft of the RAP is now under public review. The final draft is expected to be submitted to the IJC by April 1989. The State is cooperating with Superfund and priority watershed designations to prevent a duplication of effort. In addition, the State recently completed an update to the Sheboygan Water Quality Management Plan (as required by Section 208 of the Clean Water Act). The State will submit this as a supplement to the RAP, which is projected for completion in early 1989.

Milwaukee Harbor

The Milwaukee Harbor AOC encompasses the lake level portions of three rivers, Milwaukee Harbor, and the nearshore areas of Lake Michigan. The rivers are the Lower Milwaukee River, the Menominee River, and the Kinnickinnic River. Major water quality problems include sediments contaminated with toxic inorganic and organic substances, low dissolved oxygen levels, a fish consumption advisory, excess nutrients and sediments, high bacteria levels, lack of spawning habitat, and conditions that detract from recreational use of the area.

The Wisconsin DNR is currently completing a paper evaluating the need for developing a traditional RAP. This paper discusses the problem, objectives, activities and responsibilities, a timetable, and the public role in the process. It is currently being circulated among communities for public comment. Other RAP components are being coordinated with at least 11 completed or emerging management plans. The RAP is scheduled for completion in October 1990.

Currently, a minimum of five projects related to the restoration of beneficial uses in Milwaukee Harbor are being conducted:

- Currently, efforts are being conducted to identify nonpoint source pollution, establish objectives for nonpoint source management, and ultimately provide a cost-sharing plan to aid cleanup efforts.
- The Southeast Wisconsin Regional Planning Committee completed the Milwaukee Estuary Study in 1987, which involved intensive modeling of the rivers and harbor to determine the level of pollution control needed to meet water quality standards.
- The University of Wisconsin is developing a strategic management plan for navigation and environmental management for the Milwaukee Harbor.
- The Port of Milwaukee Authority is conducting an economic plan for the Harbor, which will address revitalization.
- Wisconsin DNR is developing an integrated resource management plan for nonpoint source pollution, fisheries, and wildlife.

In addition, a Citizens Advisory Committee is being established, consisting of a single advisory committee for the RAP, the watershed, and the integrated management plan. The State has also established a Milwaukee Revitalization Council to assess the economic, environmental, and recreational revitalization of the Milwaukee River Basin.

Waukegan Harbor

Waukegan Harbor is located on the western shore of Lake Michigan, approximately 40 miles north of Chicago in Waukegan, Illinois. The Illinois EPA is responsible for coordinating the development of the RAP for the 37 acres of contaminated harbor sediments and soils.

Specifically, the harbor's sediments and soils are ladened with PCBs. The principal source is thought to be discharges from the Outboard Marine Corporation (OMC) in the early 1970s. As much as 1.1 million pounds of PCBs contaminate the site, 300,000 pounds of which are in the harbor itself.

In 1984, USEPA set forth a Record of Decision authorizing expenditures of $21 million to clean up the site. The project was suspended, however, pending the conclusion of litigation regarding access to OMC's property. Negotiations have been under way since late 1986 between USEPA, Illinois EPA, and OMC regarding a specific proposal for corrective action that was submitted by OMC. In 1988, these negotiations led to a Consent Decree, which established the areas to be remediated, the methods to be used, and the financial responsibility, both immediate and long-term, for the cleanup. OMC will finance a trust to implement cleanup and will ensure performance of that trust. Once these remedial actions have been completed, the State will then reassess the necessity of a RAP.

Grand Calumet River/Indiana Harbor

The Grand Calumet River/Indiana Harbor Canal is located in northwest Indiana. The AOC includes the entire Grand Calumet River (13 miles long) and the Indiana Harbor, which is approximately 15 miles south of downtown Chicago. Many years of heavy industrial and municipal activity along the Grand Calumet River and the Indiana Harbor Shipping Canal have created severe water quality problems that have only recently begun to diminish. Degradation is primarily reflected in severely polluted sediments contaminated with oil and grease, PAHs, PCBs, heavy metals, and many other priority pollutants. Despite improvements over the past 5 to 7 years, the capacity to assimilate pollutants in the River and Canal is diminishing. The Indiana Department of Environmental Management (IDEM) is primarily responsible for coordinating cleanup initiatives.

A preliminary draft RAP for the Grand Calumet River/Indiana Harbor, prepared in 1986, identified numerous data gaps including information on the harbor and nearshore areas, air quality, solid and hazardous wastes, and sediment management issues. By January 1988, a revised RAP had been drafted and distributed for public comment. The primary mechanism for the development of this second draft was the Remedial Action Plan Work Group, composed of individuals from the IDEM, USEPA, USCOE, USFWS, USGS, and several public interest groups. The State is negotiating for expanded public participation, as reflected in the development of a draft public participation/outreach workplan published in October 1988. The work plan, to be implemented in FY 1989, includes recommendations for making videotapes, buying television time, conducting workshops and seminars, and providing other general outreach to neighborhoods and others the RAP will affect. The goal of the workplan is to rally community support for the RAP. The State plans to submit a final RAP draft to IJC in early 1989.

The Indiana RAP will focus on corrective action for solid and hazardous waste management issues and will recommend further assessment of sediment contamination and air deposition. Some studies pertaining to the contaminated sediment issue are in progress. IDEM has contracted with the USCOE to write an Environmental Impact Statement by early 1989 that defines management options for contaminated sediments in the River and Canal. In addition, work has begun on a State-funded study to define the amount and characteristic of sediment buildup in the Grand Calumet River. The USCOE is conducting a similar study in the Indiana Harbor.

Kalamazoo River

The Kalamazoo River is located in the southwest portion of Michigan's lower peninsula. The river flows in a westerly direction and discharges into Lake Michigan. The major problem in the Kalamazoo River is PCB contamination of biota, water, and sediments. Historically, the primary source of PCBs has been wastewater discharges from paper industries. Presently, however, problems are directly attributable to inplace PCB-contaminated sediments, where an estimated 230,000 pounds of PCBs reside.

The draft RAP for the Kalamazoo River, prepared in 1986, includes cost/benefit analyses, tentative timetables, and feasibility studies. In addition, specific remedial actions have been evaluated, although no particular methods have been officially selected. Georgia Pacific Corporation completed a State-requested study of PCB-contaminated waste disposal ponds, as well as a follow-up study to recommend options for remedial action. The Michigan Department of Natural Resources (DNR) is currently evaluating these options. Other studies reported in Appendix A of the 1987 Water Quality Board Report to the IJC are ongoing. No new research initiatives were undertaken in late 1987 or 1988.

The Michigan DNR has reviewed and responded to public comments on the first draft of the RAP. The final RAP was planned for submission to IJC in October 1988; however, the deadline was postponed because of the State's involvement in civil litigation against Allied Paper Incorporated and other parties that may be contributing PCBs to the river.

Muskegon Lake

Muskegon Lake is a 4,150-acre inland coastal lake located in Muskegon County along the eastern shoreline of Lake Michigan, north of the City of Muskegon. Before 1973, Muskegon Lake received direct discharges of industrial process wastewater, municipal wastewater treatment plant effluent, combined sewer overflows, and urban runoff. The excess nutrient enrichment and solids and toxic substance loadings resulted in nuisance algal blooms, reduced oxygen concentrations in the water column, tainted fish, and contaminated sediments. Petroleum, chemical, and other heavy industries in the area have also contributed to contaminated ground water.

The Muskegon Lake RAP has been submitted to IJC for secondary review. Most of the remedial actions included in the RAP have already been taken. Proposed actions concern studies regarding the environmental health of localized areas (i.e., tributaries and tributary mouths) that do not affect the AOC as a whole.

Michigan is currently submitting fish tissue samples of bass and walleye for laboratory analysis. Data is expected by April 1989 and should provide information on the sources of PCBs, chlordane, and mercury. Preliminary analysis indicates that atmospheric deposition, rather than point or localized sources, is responsible for increased contamination. Remedial action to contain seepage of contaminated ground water into Little Bear Creek has begun.

White Lake

White Lake is also located in Muskegon County, along the eastern shoreline of Lake Michigan in the vicinity of Montague and Whitehall, Michigan. This AOC includes White Lake proper and a 0.4 km zone around the lake. The major environmental problem here is contaminated ground water entering White Lake from the Occidental (Hooker) Chemical Company property. The contaminants of concern include trichloroethylene, carbon tetrachloride, and perchloroethylene in ground water, as well as hexachlorobutadiene, hexachlorobenzene, and octachlororcyclopentene in the soil. Michigan DNR recently tested sediments as a potential source for PCBs and chlordane found in carp. Preliminary results indicate that these two contaminants are below the detection level for sediment.

The RAP has been submitted for secondary review by the IJC and most of the remedial actions embodied in the plan have been taken. Attention is now being focused on more localized problems that do not affect the AOC as a whole.

Lake Huron

Lake Huron is the second largest Great Lake in terms of surface area (59,700 km^2). Like Lake Superior, Lake Huron has a drainage basin that supports lower population densities and more forested lands than the other Great Lakes. Consequently, the quality of the open waters of Lake Huron is generally high, with levels of nutrients and major ions within GLWQA objectives.

Concentrations of dieldrin and DDT in Lake Huron lake trout are below the Agreement objective, although there appears to be no decreasing trend in concentrations since 1979. As with most of the other Great Lakes, Lake Huron's PCB concentrations in lake trout continue to exceed the objective. There also does not appear to be a trend of decreasing PCB concentrations since 1979. Public health fish advisories have been issued suggesting that the consumption of lake trout, rainbow trout, and brown trout caught in Lake Huron waters be restricted.

Of the four AOCs on Lake Huron, only Saginaw Bay exists within U.S. boundaries.

Saginaw Bay

Saginaw Bay is a western extension of Lake Huron located in the east central portion of Michigan's lower peninsula. Anthropogenic inputs to the Bay are dominated by agriculture in the rural areas of the Basin and by industrial and municipal wastewater discharges from four major urban areas -- Flint, Saginaw, Bay City, and Midland, Michigan. The major water quality issues of concern are eutrophication and toxic contamination, including PCBs and heavy metals.

The final version of the Saginaw Bay RAP was produced in October 1988. The most significant action taken since 1987 is the development of a mechanism for public education and outreach under the auspices of the Saginaw Bay Natural Resources Steering Committee (SBNRSC). This Committee was formed in July/August 1987. In September, the State submitted a rough version of the RAP to SBNRSC, which the Committee reviewed for about 6 months, providing the State with comments that were later incorporated into the RAP. A similar process was followed for a second draft of the RAP.

The Committee is also in the process of establishing a nonprofit corporation to set up a fund that would respond to natural resource problems throughout Saginaw Basin. SBNRSC activities for 1989 include completing the nonprofit application process activities; gathering personnel to administer the nonprofit corporation; maintaining interaction between the public and the Michigan DNR regarding RAP activities; producing a lay version of the RAP consisting of a 55-page brochure to be distributed to the public; issuing a quarterly newsletter dealing with Committee activities, as well as RAP issues and general resource issues; and establishing a nonpoint source committee to coordinate and direct the nonpoint source management efforts on a basin-wide scale.

St. Clair River

The St. Clair River is a connecting channel that serves as an outlet of Lake Huron, flowing south to Lake St. Clair. The St. Clair River is shared by the United States and Canada. The river is an important international waterway with heavy demands placed upon it as a shipping channel and as a source of water for commercial, industrial, and domestic uses. Sediments have been contaminated by chlorinated organics and volatile hydrocarbons, while the water column has been degraded by discharges of nutrients and toxic substances from industrial and municipal point and nonpoint sources and from inplace pollutants.

The St. Clair River RAP's schedule has been extended to September 1990. Delays can be attributed to extensive efforts in this region to complete the UGLCC Study. The study will contribute new data that will be incorporated into the RAP. A Binational Public Advisory Council is in place that contributes to RAP development efforts.

Lake St. Clair

Lake St. Clair is a small shallow lake that connects the St. Clair River with the Detroit River between Lakes Huron and Erie. It supports an active recreational fishery, as well as an international navigation channel.

Clinton River

The Clinton River AOC is located on the eastern shore of Michigan, approximately 15 miles north of Detroit's Belle Isle and discharges into Lake St. Clair at Mount Clemens, Michigan. In the past, nutrients, oxygen-consuming substances, and heavy metals have been discharged to the Clinton River by industries and municipal wastewater treatment plants, resulting in low dissolved oxygen and degradation of biological communities downstream of the discharges. Impaired uses have been caused by exceedingly high fecal coliform bacteria counts, heavy metals, and PCB-contaminated soil.

A RAP for this site was completed in October 1988 and was submitted to the IJC in early November. Thus far, sources of contamination have been identified, but no remedial action has taken place. The State is waiting for RAP recommendations to be approved.

Detroit River

The Detroit River connects Lake St. Clair and Lake Erie and serves as an international boundary between Michigan and Ontario. The Detroit River AOC is the third international AOC. The Detroit River is used extensively for shipping, recreation, and public and industrial water supply. The river receives treated wastewater from numerous municipal and industrial facilities, direct storm runoff, and combined sewer overflows. Sediments contain high levels of PCBs, heavy metals (mercury, cadmium, chromium, copper, and zinc), and oil and grease.

This AOC has been a major focus of the UGLCC Study. The information gathered will be particularly useful in developing the Detroit River RAP. The Detroit River RAP is scheduled for submission to the IJC by December 1989.

Lake Erie

Lake Erie is the fourth largest Great Lake in terms of surface area (25,700 km^2)and is the most shallow lake, with a mean depth of only 19 meters. It consists of three distinct basins that differ in water quality characteristics. Lake Erie's shores are highly urbanized and its major tributaries drain intensively farmed soils. Lake Erie was the first of the Lakes to show systemwide signs of cultural eutrophication, but was also quicker to respond than the other Lakes to cleanup efforts because of its relatively short retention time.

Concentrations of DDT and dieldrin in Lake Erie remain below the Agreement objective for fish tissue concentration. PCB concentrations are elevated above the objective level, with concentrations in walleye being about five times the objective level. Both carp and catfish are the subject of public health fish consumption advisories, with restricted consumption being recommended in New York and no consumption being recommended in other States bordering the Lake.

The Water Quality Board has designated seven AOCs within the U.S. boundaries of Lake Erie, discussed below.

Rouge River

The Rouge River flows through Metropolitan Detroit and empties into the Detroit River. The lower Rouge River is the most severely polluted river in the Basin. Sediments are heavily contaminated with toxic substances and organic sludges, precluding the presence of normal aquatic life. Toxics include cadmium, chromium, copper, lead, mercury, nickel, and zinc. The river is also moderately polluted with PCBs that are bioaccumulating in carp and catfish.

The first draft of the RAP was submitted to the IJC in 1988. The State is simultaneously conducting discussions with local communities. The RAP recommends implementation and remedial action rather than further investigation and assessment. The State plans to make a final submission to IJC in January 1989, but views the RAP as a fluid document that will be revised continually to reflect yearly efforts until the Rouge River can be removed from the AOC list.

River Raisin

The River Raisin is located in the southeastern portion of Michigan's lower peninsula in Monroe County, Michigan. Problems that exist include heavy metals (copper, zinc, and chromium) and PCB contamination of sediments and the water column, sedimentation, and siltation from nonpoint sources.

The RAP was submitted in October 1987 and IJC's comments have been incorporated. The RAP will be updated as needed. Public meetings were held before the RAP was developed to gain community input, and the public was asked to review the draft upon its completion. The RAP already had a strong base of public support, however, building upon an existing Rouge River Watershed Council, to the north of the River Raisin. The Council acted as a Citizens Advisory Committee, developing and contributing to community support and providing publicity.

The Michigan DNR has undertaken several studies to date in support of the River Raisin RAP. The State completed a caged-fish study in July and August 1988 (fish were held for 28 days in cages suspended in the water column, then the fish tissue was sampled) to test for bioaccumulation/bioconcentration. Samples have been submitted to a laboratory for analysis, but there are no results to date. The State is also conducting preliminary sediment samples in six different locations to identify hot spots and other sources of PCBs and heavy metals. Both of these studies were funded with an $87,000 grant under Michigan's Act 307. Several other cleanup projects that were recommended in the RAP are being conducted independently of RAP implementation. Both the Ford Motor Company and Port of Monroe have been designated Act 307 sites, and remedial action programs are being developed.

Maumee River

The Maumee River AOC has been tentatively identified as the area from river kilometer 33 to the mouth, Maumee Bay, the nearshore area southeast of the mouth, and the lower segments of several streams tributary to the main stem and the Bay. Water quality violations include dissolved oxygen, ammonia, arsenic, lead, copper, zinc, cadmium, iron, mercury, and fecal coliform bacteria. Fish tissue samples indicate elevated PCB levels in whole-body composites and sediments polluted with oxygen-consuming materials, cyanide, arsenic, copper, nickel, zinc, iron, ammonia, total phosphorus, and oil and grease.

The Toledo Metropolitan Area Council of Governments (TMACOG) has initiated a baseline investigative study describing the problems of this AOC. The report has been submitted to Ohio EPA, and the two groups are now in the process of negotiating the next step (i.e., determining who will take the lead for the draft RAP). The RAP completion date is set for August 1989. TMACOG will draft and revise as necessary a recommendation paper on which Ohio EPA will base its RAP development. TMACOG will continue to lead local involvement since they were responsible for organizing the local communities into a Remedial Action Advisory Committee, which is composed of both a technical and a public outreach component.

Black River

The proposed boundaries for the Black River AOC are the lower 15 miles of the river from Elyria to the mouth, the harbor, and the adjacent nearshore. Violations of Ohio water quality standards for protection of warm-water habitat are noted in the Black River for dissolved oxygen, ammonia, fecal coliform bacteria, iron, lead, phenol, cyanide, cadmium, and copper. Elevated concentrations of biological oxygen demand, total phosphorus, and zinc are also common. In addition, sediments in the harbor are heavily polluted with metals, oils and grease, and oxygen-consuming materials. A fish consumption and contact advisory is still in effect for the lower 5 miles of the river. The advisory was issued in 1983 due to a high incidence of tumors in fish. The occurrence of tumors has been linked to comparatively high PAH levels in the sediment adjacent to the old U.S. Steel Coke Plant.

GLNPO's contractor completed a background report for this AOC in 1986. A RAP process integrating public participation has not yet been developed for the Black River, but a number of major remedial activities are in progress and nearing completion. Activities include major improvements to the Elyria and Lorain municipal treatment plants and sewers. In addition, U.S. Steel is planning to dredge PAH contaminated sediments from the river in the summer 1989. Currently, it is anticipated that Phase I of the Black River RAP will be submitted to IJC in 1990.

Cuyahoga River

The Cuyahoga River winds its way from a reservoir just south of East Clarendon southwest to Cuyahoga Falls and then flows north northwest through Cleveland, emptying into Lake Erie. The most impacted area of the Cuyahoga River is the shipping channel. The natural hydrology and morphometry of this segment have been altered through channel dredging and shoreline development. The lower river is also affected by industrial dischargers, including steel mills and chemical companies, urban runoff, combined sewer overflows, and municipal dischargers. Violations of Ohio water quality standards occurred with dissolved oxygen, cyanide, iron, and copper, as well as ammonia, fecal coliform bacteria, phenol, lead, cadmium, and zinc. Sediments are heavily polluted with ammonia, total Kjeldahl nitrogen, phosphorus, cyanide, oil and grease, cadmium, chromium, copper, lead, manganese, nickel, zinc, iron, and volatile solids.

The first public meeting was held regarding a RAP for the site in November 1987. Ohio EPA identified approximately 30 individuals to create the Cuyahoga Coordinating Committee (CCC). The CCC is further divided into three work groups: Communication, Technical, and Resource. A Policy Advisory Committee will be established to review and comment on the implementability of the RAP recommendations. The Ohio EPA is anticipating RAP completion in 1991.

Ashtabula River

The Ashtabula River AOC includes the lower 2 miles of the river, the harbor, and the adjacent nearshore. The major concern is sediments that have been contaminated with oxygen-consuming materials, metals, industrial chlorinated organics, and PCBs. The primary source of these pollutants was past industrial discharge to Fields Brook, a tributary to the lower river. Fields Brook sediment was subsequently classified as hazardous and cleanup is being addressed under Superfund.

A local advisory council was established in February 1987 and divided into subcommittees to provide both technical and public outreach support. Recent RAP efforts have focused on coordination with the Fields Brook Superfund site to dredge contaminated sediments in the river. The river has not been dredged since 1962, and the water is becoming too shallow to support the extensive marinas that now line the shores. The dredging program is being coordinated with the USCOE. RAP activities will stress corrective action, rather than assessment or management practices. The Ashtabula River RAP is scheduled for completion in late 1989.

Buffalo River

The Buffalo River is located in western New York and empties into Lake Erie. The River is approximately 6 miles long and is fed by three major tributaries: Cayuga, Cazenovia, and Buffalo Creeks. The AOC includes the lower portion of the river, the river's mouth, and the nearshore lake area surrounding the harbor. The Buffalo River has been subject to pollution problems such as bacteria, oil, excessive levels of phosphorus, chlorine, phenol, mercury, and general discoloration since the 1940s. New and updated municipal wastewater treatment facilities and controls on industrial point source discharges have reduced significantly most of the conventional pollutants. The major problem in the Buffalo River aquatic system currently is toxic substances, including heavy metals, pesticides, dioxin, and industrial organic compounds (such as PCBs, chlorobenzenes, and PAHs).

A draft RAP is scheduled for January 1989. The draft will receive public review and submitted to IJC by May 1989. The RAP will recommend corrective action, but will not provide a detailed workplan. This site also has a Citizens Advisory Committee that has played a significant role in the development of the RAP.

Niagara River

The Niagara River, the fourth connecting channel, connects Lake Erie and Lake Ontario and forms the international boundary between Canada and the United States. The river is a source of drinking water and industrial process and cooling water; is an energy source and a major tourist attraction; and receives discharges and wastes from industries and municipalities along its shores. The major issue in the Niagara River is toxic substances and their potential effects on human health and the ecosystem. Water quality criteria are exceeded for heavy metals, including aluminum, cadmium, chromium, copper, lead, and silver. Mercury, arsenic, cyanide, and selenium, as well as several pesticides, have begun to pose water quality problems. Sediments are also contaminated with conventional pollutants, heavy metals, industrial organic chemicals, PCBs, and pesticides.

The preliminary steps for developing a RAP began in 1988. RAP development will begin in January 1989, with an anticipated completion date of January 1991. The development of a Citizens Advisory Committee is also forthcoming. The RAP will incorporate the 1984 findings of the Niagara River Toxics Committee and the Niagara River Toxics Management Plan discussed later in this report.

Lake Ontario

Lake Ontario is the smallest of the Great Lakes (19,520 km^2), but with a mean depth of 86 meters, is deeper than Lake Erie. Located at the end of the Great Lakes chain, Lake Ontario receives nutrients and toxic contaminants contained in the outflow of upstream systems. Because of this source and those within the basin, Lake Ontario generally has high open water pollutant concentrations.

Lake trout in Lake Ontario contain PCB concentrations that greatly exceed the Agreement objective. Even though there appears to be a slight downward trend in concentration over the last 9 years, PCB levels still are ten times the Agreement objective. DDT concentrations in lake trout approach the GLWQA objective and apparently have not declined significantly in recent years. Dieldrin concentrations in lake trout appear to be declining in Lake Ontario and are already lower than the Agreement objective of 0.3 mg/kg, however. Public health consumption advisories have been issued for numerous fish species taken from Lake Ontario.

The Water Quality Advisory Board also identified four AOCs within the U.S. boundaries of Lake Ontario. These areas, which exceed GLWQA water quality objectives for at least one parameter, are as follows.

Eighteenmile Creek

The Eighteenmile Creek AOC includes Eighteenmile Creek, Olcott Harbor, and the nearshore waters of Lake Ontario at Olcott, New York. Water quality, sediment, and fish have been contaminated by heavy metals, PCBs, pesticides, and other volatile organic compounds.

GLNPO's contractor prepared an initial draft RAP in September 1988. NYSDEC has no timetable for completion.

Rochester Embayment/Genessee River

The Rochester Embayment AOC is defined as nearshore Lake Ontario at Rochester and Rochester Harbor, New York, and the Genessee River located in Monroe County. Major problems include toxic contamination of the water column and sediments, PCBs and mirex in fish flesh, and ammonia toxicity.

GLNPO's contractor prepared an initial draft RAP in 1987. The draft RAP for this site is under way and should be completed by December 1990. The Monroe County government will be the primary agency to develop issues presented in the RAP. Public participation will be achieved through several existing citizen committees already involved with environmental issues.

Oswego River

The Oswego River AOC includes the Oswego River, Wine Creek, and the adjacent nearshore waters of Lake Ontario at Oswego, New York. Major problems include nutrient and toxic substance contamination of water and sediments, PCBs and mirex in fish flesh, and probable ammonia toxicity.

GLNPO's contractor prepared an initial draft RAP in 1987. The draft RAP for this site is scheduled to be completed by November 1989. A Citizens Advisory Council has been designated and has been very active in providing both technical and political support.

St. Lawrence River/Massena

The St. Lawrence River has been identified as an AOC because of degraded environmental conditions in the Cornwall/Lake St. Francis and Maitland areas in Canada and the Massena, New York, area in the United States, which are contaminated with heavy metals, PCBs, and other toxic substances. RAPs for this site are being developed in parallel by both New York and the governments of Canada and Ontario. Quebec and the Mohawk Nation at Akwesasne are participating in the effort. The New York State Department of Environmental Conservation is directing GLNPO's contractor in preparing an environmental data base to assess the information available on impaired uses in the AOCs. In addition, SAIC is analyzing 1984 sediment data from seven segments of the St. Lawrence River. The anticipated date of RAP completion is June 1990.

LAKEWIDE MANAGEMENT PLANS

Lakewide Management Plans (LMPs) provide an approach for reducing contaminant loadings in open lake waters and involve the same basic principles as those for RAPs. However, LMPs differ from RAPs in the breadth of their focus, since they address entire lakes rather than the more localized AOCs. Given this scope, monitoring becomes more complex and airborne deposition becomes a far more important factor. In addition, the appropriate mix of remedial actions and coordination among jurisdictions differs from that of the RAP process.

The concept of lakewide management planning involves a stepwise problem-solving process. In developing and implementing LMPs, the U.S. and Canadian Governments, in cooperation with the States and Provinces, are to:

- Define the problem, in terms of threats posed by specific critical pollutants
- Select remedial measures
- Implement remedial programs
- Monitor ecosystem recovery
- Remove designation of a Critical Pollutant, once it can be demonstrated that it no longer presents a problem.

GLNPO, in consultation with the States and other EPA offices, has initiated a detailed study of technical and management options for the development of LMPs. In particular, GLNPO is working with the States to relate this process to existing programs and requirements under the

Clean Water Act. This study will identify specific approaches for accomplishing each LMP step, analyze the advantages and disadvantages of these approaches, and develop a prototype LMP outline.

This analysis of alternatives is expected to draw heavily upon the experience gained to date in a number of recent studies and model lake management efforts, including the Niagara River Toxics Project, the Green Bay Mass Balance Project, the Lake Michigan Toxic Pollutant Control/Reduction Strategy, the Lake Ontario Toxics Management Plan, and the Upper Great Lakes Connecting Channels Study. As summarized in Table 2, these efforts have contributed substantially to the evolution of the lakewide management planning concept. Additional information on each of these and other key studies and planning activities is provided below.

Niagara River Toxics Project

The Niagara River Toxics Committee was a binational group formed in 1981 to investigate toxic chemicals in the Niagara River, its tributaries, and a small part of Lake Erie. The objectives of the project were to identify specific contaminants of concern; determine the relative contribution of sources of contaminants to the total load levels; monitor concentrations of key contaminants in water, sediment, and biota; and assess the effectiveness of existing control programs.

In 1984, the Committee reported on the results of its study. The Committee identified 261 manmade chemicals that occurred in the Niagara River, but focused on the distribution and sources of eight contaminant groups (e.g., acid extractables, PAHs, PCBs). Numerous improvements in regulatory programs were recommended to reduce point source loadings. Other recommendations included expediting hazardous waste site cleanups, improving waste management practices, and supporting additional studies on the local hydrogeology of contaminated ground water.

A number of areas of contaminated sediment were identified as potential targets for remedial action. Requirements for long-term monitoring were discussed and recommendations were made on quality assurance requirements. The Canadian members of the Committee also recommended that the Niagara River serve as a pilot site for implementing a toxic loading allocation plan based on a mass balance concept, and that regulatory programs be designed to progressively reduce discharges of key contaminants toward a "zero discharge" goal.

Subsequently, the USEPA, Environment Canada, the Ontario Ministry of the Environment, and the New York State Department of Environmental Conservation signed a four-party agreement to restore Niagara River water quality. The agreement, signed in February 1987, is embodied in the Niagara River Toxics Management Plan that calls for a 50-percent reduction of the total loads of persistent toxicants from point and nonpoint sources over the next decade.

The first phase of the agreement, completed in August 1987, created a list of 92 persistent toxic pollutants of concern. From that list, ten chemicals were identified for a 50 percent reduction based upon exceedances of various standards, guidelines, or objectives. Although this effort occurred outside the IJC framework, it is an example of an institutional arrangement among multiple jurisdictions to reduce the total loadings of persistent toxic chemicals to a Great Lakes water body not presently achieving all attainable uses.

TABLE 2: CONTRIBUTIONS OF SELECTED RECENT ACTIVITIES TO THE EVOLUTION OF LAKEWIDE MANAGEMENT PLANNING

Elements of Lakewide Management Plans	Niagara River Project/ Niagara River Management Plan	Upper Great Lakes Connecting Channels Study	Lake Michigan Toxic Pollutant Control/Reduction Strategy	Green Bay Mass Balance Project	Lake Ontario Toxics Management Plan
Defining the Problem					
Surveillance and Monitoring Methods/Strategy					
• Sources	●	●	●	●	●
• Ambient Ecosystem	○	●	●	●	●
Fate/Distribution Assessments by Contaminant	○	◗	○	●	●
Effects/Risk Assessments by Contaminant			◗		
Source/Pathway Characterization					○
• Source Inventory	●	●	○	●	●
• Load Measurements/Estimates	○	●	○	●	○
Establishing Load-Concentration Relationships		○	○	●	●
Exposure Pathway Characterization		○	○	●	●
Establishing Exposure/Dose Relationships					○
Priority-Setting Process for Selecting Remedial Measures					
Water Bodies Areas	○		○		○
Pollutants	●		●		●
Sources	●		●		●
Setting Load Reduction Objectives			●	●	●
Evaluating the Effectiveness of Existing Remedial Action Programs	○	○	◗		◗

TABLE 2: CONTRIBUTIONS OF SELECTED RECENT ACTIVITIES TO THE EVOLUTION OF LAKEWIDE MANAGEMENT PLANNING (continued)

Elements of Lakewide Management Plans	Niagara River Project/ Niagara River Management Plan	Upper Great Lakes Connecting Channels Study	Lake Michigan Toxic Pollutant Control/Reduction Strategy	Green Bay Mass Balance Project	Lake Ontario Toxics Management Plan
Priority Setting Process for Selecting Remedial Measures					
Evaluating Remedial Action Alternatives			●	◗	●
Reaching Agreement on Remedial Measures Strategy	○		○		○
Implementing Remedial Programs					
Developing Operational Plans for Remedial Measures	◗		○		○
Tracking Remedial Measures Implementation	○		●		●
Evaluating Program Cost-Effectiveness					
Monitoring Ecosystem Recovery					
Surveillance and Monitoring to Determine Effectiveness of Remedial Actions	●		●		●
Removing Critical Pollutant Designations					
Determining When Objectives Have Been Met	○		○		◗

* Indicates to what degree the study dealt with a particular element of LMPs
○ element discussed
◗ element discussed in some detail
● element discussed in greater detail

Upper Great Lakes Connecting Channels Study

The Upper Great Lakes Connecting Channels (UGLCC) Study is a binational effort initiated in 1983 to address four key contaminated waterways within the Great Lakes Basin. This Study has served, in many ways, as a key model for the more recent lake management efforts described above. The objectives of the Study were to:

- Determine the existing environmental condition of the St. Marys River, St. Clair River, Lake St. Clair, and the Detroit River and identify information gaps
- Undertake additional, needed studies to:
  - Identify and quantify the impacts of conventional and toxic substances from point and nonpoint sources
  - Determine the adequacy of existing or proposed control programs to ensure or restore beneficial uses
  - Recommend appropriate control and surveillance programs to protect and monitor these waterways and the downstream lakes.

The results of this Study, which involved 12 government agencies and a multitude of academic institutions and cost approximately $20 million, are presented in a draft final report issued in July 1988. This final report represents a distillation of 19 media-specific reports, which were based on 170 individual data reports.

An overview of the findings of the UGLCC Study are summarized below:

- The UGLCC Study confirms that many of the environmental quality problems of the region cut across political jurisdictions and can only be resolved through coordinated, long-term planning efforts by the jurisdictions affected.
- There have been substantial reductions in conventional pollutants, however, ongoing and historical discharges continue to affect the system. Elimination of combined sewer overflows is strongly recommended.
- All four water bodies suffer from contaminated sediments, high concentrations of oil and grease (except Lake St. Clair), and the bioaccumulation of certain toxic pollutants in local aquatic organisms. Levels of contaminants in waterfowl need to be examined.
- Point sources continue to contribute the largest loadings of contaminants. Nonpoint loadings can be locally significant, but quantification of these inputs is needed. Information is also needed on the relative contribution of waste sites.
- Accidental spills are an insidious problem that requires immediate attention.

Specific recommendations for remedial action in each connecting channel are outlined in the report.

Green Bay Mass Balance Project

The USEPA, in conjunction with a number of other U.S. Government agencies and the States of Michigan and Wisconsin, is developing and testing a modeling framework to increase the information base on sources, transport, and fate of toxic compounds in the Fox River/southern Green Bay area. The overall goal of the Green Bay Mass Balance Study is to test models for toxics to improve our understanding of the sources, transport, and fate of toxic compounds, to evaluate the technological capability to measure multimedia loadings to a system, and ultimately to guide and support regulatory activity. The Study will serve as a pilot for future modeling studies of Great Lakes ecosystems.

The Mass Balance Study will apply models to PCBs, dieldrin, cadmium, and lead. The physical/chemical models will be coupled with a food chain model to allow estimation of body burdens in target fish species: carp, brown trout, and walleye. The integrated model will then be used to predict concentrations in the water, sediment, and biota under alternative regulatory and remedial actions.

The project was initiated in 1986, with the development of a monitoring plan and the establishment of a quality assurance program for evaluating analytical and field methods to be employed. During FY 1987, field reconnaissance was done in the Bay and tributaries, and the first atmospheric deposition monitoring stations were established in preparation for the main field season, August 1988 through September 1989. Samples to be collected include bottom sediments, Bay-Lake exchange, atmospheric deposition, water and suspended sediments, tributary loads, point and nonpoint sources, ground water, and biota.

As envisioned, the study will incorporate the following components:

- Comprehensive quantification of loads from all significant sources (e.g., atmosphere, tributaries, ground water, point, and nonpoint)
- Determination of the net rate of exchange of contaminants between environmental compartments (e.g., sediment, water, biota, and air)
- Net rate of exchange with Lake Michigan.

Analysis of field data, modeling, and interpretation is scheduled to begin in 1990. These activities will be guided by several specific requirements, including:

- Usefulness in predicting concentrations of key contaminants in fish to help determine human cancer risks
- Utility for EPA and the State in making regulatory decisions
- Applicability of the pilot study as a model for larger, lakewide studies.

Modeling results will be determined and the final report will be completed in 1991.

Lake Michigan Toxic Pollutant Control/Reduction Strategy

EPA's Region V and the States of Illinois, Indiana, and Michigan have prepared a Lake Michigan Toxic Pollutant Control/Reduction Strategy. The objectives of the strategy are to fully restore the multiple uses of Lake Michigan and to protect human health and the Lake Michigan ecosystem by achieving a significant reduction in the loading rates of toxic pollutants. The strategy includes specific commitments for each State, by fiscal year, which have been incorporated into the annual State program plans negotiated with the Region V Water Division. The strategy anticipates using a whole-lake mass balance approach to modeling toxic pollutants and evaluating potential regulatory controls. The Green Bay Mass Balance Study is identified as a key milestone in the development of a LMP for Lake Michigan.

USEPA Region V's Water Division has negotiated performance objectives for implementation of the Lake Michigan Strategy into the State Water Program Plans of the Lake Michigan States. Included are elements requiring a status summary of technology-based permit limits, including those for the Lake Michigan Pollutants of Concern; an initiative to acquire the capability to calculate and sum loads from point sources to specific Lake Michigan tributaries and to Lake Michigan as a whole; and an inventory of municipal waste combustion sources, cross-referenced in the Lake Michigan State Air Program Plans.

To assist the Lake Michigan States in developing a load quantification capability, GLNPO is accessing the Permit Compliance System data base and roughly calculating loads by multiplying average flow with average concentration. Such screening level estimates are intended to focus additional monitoring attention on those sources contributing significant loads of pollutants of concern and select toxic metals to Lake Michigan. As a complement to this effort, GLNPO has also obtained loading inventories of pollutants of concern and select toxic metals to Lake Michigan tributaries using Michigan's Critical Materials data base. While strictly applicable to Michigan sources, the information may assist in identifying significant point source categories and in defining screening level discharge factors applicable to other Lake Michigan sources.

Lake Ontario Toxics Management Plan

In February 1987, EPA, the State of New York, Environment Canada, and the Ontario Ministry of the Environment signed a declaration of intent to prepare a Toxics Management Plan for Lake Ontario. The draft plan, prepared in 1988, cites bioaccumulation of toxic chemicals in fish to levels that make them unsafe for human consumption as the most serious known problem in the Lake. To address the problem of toxic pollution in Lake Ontario, the draft plan calls for three major actions:

- Full implementation of current programs, such as the State Pollutant Discharge Elimination System program in New York State and the newly developed Municipal Industrial Strategy for Abatement program in Ontario.
- Development and implementation of RAPs to address the problems in eight geographic AOCs, such as the Niagara River and Hamilton Harbor.
- The development and implementation of chemical-specific management plans to reduce the levels of problem toxics (e.g., PCB, mercury, mirex, chlordane, dioxin, DDT, dieldrin, hexachlorobenzene, iron, aluminum, and octochlorostyrene) below protective ambient standards. As a check on the effectiveness of chemical-specific management plans, ecosystem objectives will be developed and monitored independently.

Together, the administrative and technical initiatives described above represent a concerted effort by the United States to develop the institutional arrangements, programmatic structure and function, and technical tools necessary to carry out this crucial mandate, despite its unprecedented scope and complexity.

Other Activities Related to Lakewide Management Plans

The Great Lakes States have also worked jointly towards achieving the goals of the GLWQA. In June 1986, the Governors of the eight Great Lakes States signed the Great Lakes Toxic Substances Control Agreement. This Agreement pledges the States to treat the Lakes as a single ecosystem despite political boundaries, acknowledges that toxic pollutants are the foremost problem to be addressed, and lays out goals for the States. More recently, the Governors agreed to establish a permanent fund for Great Lakes studies. Many of the activities under both of these State agreements will lead directly and indirectly to the completion of and implementation of management plans, and ultimately to the attainment of the Agreement objectives. Considerable progress has already been made toward this goal by USEPA Headquarters and States' Regional regulatory and remedial programs.

GLNPO has begun to develop and test a number of technical tools that will be necessary for LMP implementation. In terms of technical guidance, GLNPO and the Office of Water Regulations and Standards have discussed the writing of a Great Lakes Waste Load Allocation Guidance Document. GLNPO also continues to work with Region II and V Superfund programs to institutionalize sediment cleanup priorities based within the Superfund Program on Great Lakes area and lakewide exposure/load reduction needs. With respect to technical tools for problem characterization, GLNPO is developing, via grants to Great Lakes academic institutions, the following:

- Statistical methods for determining the relationship between sampling frequency and tributary waste quantification, accuracy, and precision
- State-of-the-art atmospheric concentration/deposition monitoring station
- Computerized concentration volume-weighting scheme to systematically calculate area lakewide concentration averages
- Mathematical models of the Great Lakes system capable of relating loading rates to ambient concentrations in water, sediment, and biota (in cooperation with the Large Lakes Research Station, Grosse Ile, Michigan)
- State-of-the-art effects monitoring tools, such as sediment toxicity and bioaccumulation test methods, the fish embryo-larval carcinogen assay, and the fish or sediment extract liver hepatoma P450 induction assay.

USEPA's Office of Research and Development will also be testing proposed sediment quality criteria in the Fox River/Green Bay system.

In addition, GLNPO has developed a pesticide inventory for Erie County in Ohio via Interagency Agreement (IAG) with Ohio State University's Cooperative Extension Service. The inventory will complement the work on nutrient and pesticide concentrations during storm events being conducted under a GLNPO grant by Heidelberg University in Tiffin, Ohio, and previous demonstration projects funded through an IAG with USDA's Soil Conservation Service. Together, this information can be used to develop aids for quantifying nonpoint source loading factors for pesticides of concern based on application rate, crop type, tillage practice, land slope, soil types, and distance to surface water.

The National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory (GLERL) has continued its research to evaluate the role of chemical kinetics versus chemical equilibrium in contaminant-fate modeling. The results show that even in a relatively stable environment, contaminants in organisms are not at a steady state with respect to local sources. This research represents a significant contribution to our ability to model fate of contaminants and will be useful in AOCs and for LMPs.

Additional research at GLERL has shown that situations exist in which toxicant fate cannot be accurately predicted if toxicant effects are not modeled. This is contrary to the traditional approaches to modeling toxicant fate that implicitly assume that toxicant effects on organisms have no effect on subsequent toxicant fate.

With respect to problem remediation, GLNPO is providing contractor support to Great Lakes municipalities to test innovative phosphorus removal technologies and has funded studies of best available technology-equivalent metals removal. In addition, Region V is currently conducting specific air emissions control studies to identify potential remedial measures for air toxicants. Furthermore, GLNPO, with technical assistance from the USCOE, USFWS, and Region V, is developing design criteria for in-lake contaminated sediment disposal facilities that minimize loss rates to the lakes and human or wildlife exposure to dredged toxicants via the aquatic or terrestrial food chains. Plans for such disposal facilities, however, will be scrutinized closely given that, in some States, any in-lake disposal of contaminated sediments is considered a violation of State water quality standards and requires the responsible party to obtain a variance from the State rules. Other innovative sediment cleanup technologies will also be tested on Waukegan Harbor sediments, the most heavily PCB-polluted sediments in the entire Great Lakes system.

ANNEX 3: CONTROL OF PHOSPHORUS

Annex 3 of the GLWQA sets targets for total phosphorus loads to the Lakes, which, when achieved, would produce acceptable conditions in terms of aerobic conditions in the bottom waters of Lake Erie, and algal biomass in all of the Lakes. The 1983 supplement to the Annex confirmed target loads, quantified the further load reductions necessary to attain the targets, and called for the preparation of Phosphorus Load Reduction Plans to guide their attainment. The U.S. Government and the States have prepared and transmitted Phosphorus Load Reduction Plans to the IJC for Saginaw Bay of Lake Huron, and for Lakes Erie and Ontario.

The Supplement requires the Parties to review the effectiveness of the Plans by December 1988, and identify any remaining load reduction measures required to achieve the target loads. The reviews have not yet been completed, although it is apparent that the target loads have not yet been attained for any of the three water bodies. Phosphorus loadings to Lakes Superior, Michigan and Huron all achieve the target loads, except for Saginaw Bay.

The United States expects to provide an update of its plans during 1989. Further discussion of Phosphorus Load Reduction Plans and nonpoint source control programs are provided in the section on Annex 13.

ANNEX 12: PERSISTENT TOXIC SUBSTANCES

INTRODUCTION

The goal of the GLWQA is the virtual elimination of persistent toxic substances from the Great Lakes ecosystem; the philosophy is zero discharge. To that end, Section 2(a)(iii) of Annex 12 requires the Parties to pursue "the reduction of the generation of [Great Lakes] contaminants, particularly persistent toxic substances, either through the reduction of the total volume or quantity of waste or through the reduction of the toxicity of waste, or both." Significant progress has been made in reducing the quantities of persistent toxic substances entering the Great Lakes system from air emissions, wastewater discharges, leaks and spills, and stormwater runoff. The reporting requirements of Annex 12 focuses on activities under Section 2(a)(iii).

A variety of regulatory and nonregulatory approaches are under way in the United States to reduce new sources of toxic pollutants. The approaches include:

- Eliminating or restricting the use of toxic chemicals (e.g., bans)
- Reducing the concentration of toxic substances in commercial products
- Limiting concentrations of toxics in non-hazardous waste streams
- Regulating disposal of hazardous waste streams
- Reducing the amount of toxic substances used in manufacturing processes
- Reclaiming and recycling toxic substances from manufacturing processes or commercial products.

RESTRICTIONS ON THE DISTRIBUTION OF CRITICAL POLLUTANTS IN COMMERCE

Several environmental statutes apply to restrictions on the distribution of critical pollutants, including the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); the Toxic Substances Control Act (TSCA); and to a limited extent the Resource Conservation and Recovery Act (RCRA).

Federal Insecticide, Fungicide, and Rodenticide Act

In the United States, the manufacture, use, and disposal of some 50,000 pesticide products and devices are regulated under FIFRA as amended in 1978 (40 CFR Parts 152 to 173). The U.S. Environmental Protection Agency (USEPA) carries out this responsibility by requiring all pesticides to be registered with the USEPA, based on data adequate to demonstrate that the pesticide's use will not pose an unreasonable risk to humans or the environment. When a product is registered, certain labeling requirements must be met, including explicit directions for legal use; information on the method, rate, and site of application; directions for storage and disposal; and restrictions on use. Any application deviating from the labeled one is considered an unlawful use of the product.

The regulations provide standards for the certification of commercial and private applicators of restricted-use pesticides to ensure that these pesticides are handled and used in a safe manner. For commercial and professional applicators, methods of storage and disposal of excess pesticide products and pesticide containers are also recommended under FIFRA. In addition, RCRA regulates the treatment, storage, and disposal of some pesticide wastes. The above measures are intended to reduce the quantities of pesticides entering the environment to the minimum required for efficacious use.

If the environmental or health risks associated with a pesticide's registered use outweighs its benefits, USEPA may further limit its use in terms of pests, crops, environmental conditions, or geographic areas. In extreme cases, USEPA can move to cancel all uses of (i.e., ban) a pesticide.

The following Critical Pollutants have been banned by the USEPA: DDT, dieldrin, hexachlorobenzene, and toxaphene. Mercury's use in pesticide formulations has been severely curtailed, although some seed treatment uses continue. Voluntary restrictions on the concentrations of 2,3,7,8-tetrachlorodibenzo-para-dioxin (2,3,7,8-TCDD) in chlorophenoxy herbicides were adopted by manufacturers in 1971.

Recent Activities

In 1987, the ban on the use of herbicides containing 2,4,5-trichlorophenoxy carboxylic acids (e.g., 2,4,5-T; Silvex) and derivative esters went into effect. Historically, such herbicides were a significant source of 2,3,7,8-TCDD. Also in 1987, USEPA announced its intention to severely restrict the use of pentachlorophenol, which is contaminated with various polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) and to cancel all remaining uses of chlordane.

In addition, USEPA's Office of Pesticide Programs has initiated an accelerated review process for the registration of existing pesticides. One area of focus is lawn care herbicides, including dacthal, one of the few herbicides identified in fish tissue collected under the Great Lakes fish monitoring program.

Pesticide manufactures are more frequently initiating the removal of problematic pesticides from the marketplace prior to USEPA action. For example, the sole U.S. manufacturer of chlordane agreed not to contest the proposed registration cancellation notice, thus avoiding lengthy administrating hearings. As a result of a similar voluntary action on the part of various U.S. manufacturers, all remaining uses of Endrin are likely to be cancelled in the near future.

Serious concern over the extreme toxicity of alkylated tin compounds detected in Great Lakes waters prompted the State of Michigan to propose a ban on the use of paint formulations containing tributyl tin biocides on surfaces that could contact the aquatic environment. Of particular concern was the use of antifoulant paints containing tributyl tin as the active ingredient to prevent algae growth on recreational boat hulls. The ban went into effect in November 1988. Subsequently, Wisconsin began to pursue a similar initiative.

Toxic Substances Control Act

TSCA provides USEPA with regulatory authority (40 CFR Parts 702-799) over the manufacture, transport, storage, use, and disposal of chemicals on the TSCA Inventory intended for commercial distribution in the United States. The Act provides a broad range of authorities including reporting and notification requirements and the imposition of manufacturing and use of restrictions or bans.

TSCA also requires manufacturers of new chemical substances not on the TSCA Inventory to submit a Premanufacture Notification prior to the manufacture of the chemical, supplying information on the properties of the new substance, its intended use, the method and extent of manufacture, description of byproducts, and other data. TSCA also requires manufacturer notification of "significant new uses," which must be designated by rule, of chemical substances currently on the Inventory.

In addition, TSCA provides for Federal information requests of manufacturers and for systematic testing of existing chemicals according to priorities set by USEPA in consultation with the Interagency Testing Committee. Where new test results indicate substantial risk to human health or the environment, USEPA can restrict manufacture, storage, use, or disposal. Where unreasonable risks are found, USEPA can ban manufacture of the chemical and severely restrict its disposal.

The use, manufacture, processing, and distribution of polychlorinated biphenyls (PCBs) and PCB items are effectively banned by TSCA (40 CFR Part 761). In addition, TSCA regulations require manufacturers and processors of certain chemical substances to analyze these chemicals for the presence of halogenated dibenzodioxins (HDDs) and halogenated dibenzofurans (HDFs). If testing confirms the presence of HDDs or HDFs above the prescribed level of quantitation, additional information is required on production, process, exposure, and disposal.

Recent Activities

The private sector has become increasingly concerned about the number and quantities of toxic substances used in manufacturing and waste treatment processes. The sources of concern are four-fold:

- Existing occupational and environmental liabilities associated with toxic substances manufacture or use
- Growing paperwork burden associated with existing or new local, State, and Federal reporting requirements
- Increasing costs of solid and liquid waste disposal containing one or more listed toxic substance
- Existing public perception that the onsite storage of large quantities of highly toxic substances presents an unreasonable threat to nearby communities.

In response, many communities are voluntarily pursuing the use of various raw materials or product substitution strategies. For example, every Michigan facility discharging unsanitary wastewater is required to report annually the quantities of Critical Materials used or produced, discharged, and disposed of in solid residues. A substance is considered a Critical Material once it is added to Michigan's Critical Materials Register (CMR) by the Director of Michigan's Department of Natural Resources, who is advised by a committee of scientific experts. In response to this program, several Michigan industries have systematically started to eliminate the use of CMR-listed substances in product manufacture or wastewater treatment processes. The recent expansion of the CMR under the Clean Water Act Section 205(j) grant from USEPA Region V may further encourage this practice.

The use of PCBs in transformers and capacitors continues to be phased out, with disposal of recovered PCB oils via high-temperature incineration only. Since 1987, regulations governing the closure, cleanup, and disposal of structures contaminated with chlorinated dibenzo-p-dioxins and dibenzofurans in PCB transformer fires have been implemented, and USEPA's National PCB Spill Cleanup Policy is now in effect. Such regulations and policies will reduce the volume of contaminated matter capable of being released to the air, soil, and water of the Great Lakes ecosystem.

WASTE REDUCTION AND RECYCLING

Management of solid and hazardous waste in the United States, including waste reduction and recycling, is regulated in part by the Solid Waste Disposal Act (SWDA). The SWDA, amended in 1976, is commonly referred to as RCRA. In 1984, the SWDA was again amended via the Hazardous and Solid Waste Amendments. Subtitles C, D, and I of the SWDA regulations describe the three distinct programs: the Hazardous Waste Program (Subtitle C), the Solid Waste Program (Subtitle D), and the Underground Storage Tank Program (Subtitle I).

The Hazardous Waste Program is designed to ensure the safe and effective management of hazardous waste (40 CFR Parts 260-272). As part of the Hazardous Waste Program requirements, a paperwork manifest system is utilized that records the location of hazardous wastes. This Uniform Hazardous Waste Manifest system provides specific information on the quantity and nature of the waste and the parties involved in the waste's production, transportation, and disposal.

Specific requirements exist for generators, transporters, and owners or operators of treatment, storage, and disposal facilities. All facilities must, at a minimum, possess a USEPA identification number. Requirements for generators include proper labeling, packaging, and limited accumulation of the waste; adequate training of personnel; and development of contingency plans and emergency procedures. Transporters must be trained to adequately respond to discharges, such as spills.

The primary goal of the Solid Waste Program is to encourage solid waste management practices that promote environmentally sound disposal methods, maximize re-use of recoverable resources, and foster resource conservation. There are two facets of the Solid Waste Program: the technical standards for facilities, referred to as Subtitle D Criteria (40 CFR Part 257), and a voluntary State solid waste management program (40 CFR Part 256).

The Underground Storage Tank (UST) program is concerned with tanks having 10 percent or more of their underground volume containing petroleum products or hazardous substances (40 CFR Part 280). The UST program has five parts: a ban on unprotected new USTs (i.e., USTs without cathodic protection to protect against corrosion), notification to authorities of existing USTs, development of performance standards, State management of the program, and inspection and enforcement authority at the State and Federal levels. For an UST to be permitted, the tank's design must be shown to prevent release due to corrosion or structural failure, and that the construction of the tank is compatible with the stored waste.

To limit the quantities of sediments, nutrients, and pesticides entering water bodies from agricultural land use, USEPA has recently developed a multi-agency nonpoint source management strategy, involving, among other Federal agencies, U.S. Department of Agriculture, particularly the Soil Conservation Service. The approach to source reduction is through the encouragement of alternative tillage practices, the use of buffer strips around agricultural fields, and the transfer of technology on integrated pest management and alternative nutrient and pest management methods from the academic center to the farmer.

Recent Activities

Waste reduction and recycling activities occur at the Federal, State, and local levels. Recent activities are discussed below.

Federal

Effective enforcement of existing RCRA regulations, the banning of the land disposal of liquid hazardous waste, and increasingly stringent limitations on the land disposal of solid wastes and sludges have raised the costs of waste disposal in the United States and placed an ever-increasing waste disposal burden on a small handful of fully licensed hazardous waste incinerators. At the same time, new RCRA restrictions on the emissions of PCDDs and PCDFs from such incinerators are likely to further increase disposal costs. Onsite storage of liquid and solid hazardous wastes awaiting proper disposal also creates environmental and occupational risks and liabilities.

In response to these regulatory and economic pressures, manufacturers are increasingly interested in reducing the volume of hazardous waste generated in their processes. To this end, they are pursuing substitution of nonhazardous chemicals for those listed under Subtitle C of RCRA (40 CFR Part 261), process modifications to reduce the volumes of liquid and solid hazardous waste produced as manufacturing byproducts, and wastestream recycling within the plant if possible, but between plants if necessary.

USEPA has recently announced the creation of a new Pollution Prevention Program (PPP) to be administered by a newly created Pollution Prevention Office within USEPA's Office of Policy, Planning, and Evaluation in Washington, DC. An agency-wide advisory committee, consisting of senior managers, will be established to coordinate waste reduction efforts in USEPA's program offices.

The PPP will adopt an agency-wide, multimedia and multiprogrammatic approach to source reduction and recycling. Although there are many cultural and institutional barriers to implementing such an approach, the PPP will aggressively pursue the reduction of hazardous and toxic wastes, as well as other wastes of environmental concern such as municipal and agricultural wastes. This Program will become fully operational during FY 1989 fulfilling the Agency commitment to four objectives:

- Promote a new culture both within and outside USEPA that emphasizes pollution prevention, primarily through source reduction and secondarily through recycling
- Encourage development of State and local pollution prevention programs
- Create incentives for and eliminate barriers to pollution prevention
- Develop reliable indicators of progress in source reduction and recycling.

To achieve these objectives across the Agency, PPP will concentrate on four primary functions. First, the program will develop a cross-media pollution prevention policy and strategy and will promote the pollution prevention ethic both within and outside USEPA. Central to this activity will be the advice of the Pollution Prevention Advisory Committee. Second, the program will develop technical assistance tools and coordinate outreach programs to deliver these tools to State and local governments, the industry, the agricultural community, and the public. Third, the PPP will foster the development of innovative approaches to pollution prevention. Finally, the program will develop a coordinated information management strategy to assess and report on pollution prevention and will report on progress and problems.

Illinois

The Illinois Hazardous Waste Research and Information Center (HWRIC) and the Illinois EPA promote waste reduction through technical assistance, research information services, waste exchange operation, promotion of recycling, and related regulations.

The Illinois EPA does not require mandatory waste reduction or permit large generators to landfill their hazardous waste unless they can prove that there is no technically feasible or economically reasonable alternative. In their annual reports, generators must submit a description of the waste minimization techniques considered and tried. The Illinois EPA, in cooperation with the State Chamber of Commerce, operated the Industrial Materials Exchange Service. The Illinois EPA is also implementing a waste minimization student intern program.

Recently, the Illinois EPA and the Department of Energy and Natural Resources were awarded a RCRA Integration Training and Technical Assistance (RITTA) grant. The majority of the money will be used in a pilot project to integrate and expand the activities of the Illinois EPA and HWRIC through training and a student intern program. They will also work with two local organizations, the Center for Neighborhood Technology in Chicago and Community Contracts, Ind. of Kane and DuPage counties, to reach industry. Activities include using the computerized waste reduction advisory system and industry audits to quantify the amount and toxicity of hazardous waste reduced, developing a State action plan, providing training in waste management and minimization, and providing public outreach through seminars and workshops.

HWRIC's activities include sponsoring research, onsite technical assistance, two Statewide waste reduction conferences, and a Governor's award for innovative waste reduction. HWRIC is active with the National Roundtable of State Waste Reduction Programs and has been working with several member programs and the USEPA to develop an online national computerized waste reduction advisory system called the Multi-Option Model.

HWRIC maintains five programs: research, industrial and technical assistance, information services, data management, and laboratory services. HWRIC's $9 million Hazardous Materials Laboratory will open in spring 1990 and will include state-of-the-art analytical services to support bench- and pilot-scale laboratories for minimization and treatability studies. Research sponsored by HWRIC focuses on problem assessment and solving. This includes $200,000 for waste reduction studies, including matching-fund projects with industry. Technical assistance services include information on chemical processes, waste treatment, siting, and permitting requirements. The Center serves industries, State and local governments, and the public.

Indiana

Indiana is in the process of formalizing a hazardous waste minimization program that includes developing waste minimization audit procedures.

Indiana has held annual training workshops on waste minimization practices, including audit procedures. Pertinent waste minimization and audit procedure articles have been included on a regular basis in the bimonthly Technical Bulletin, prepared by the Office of Technical Assistance, and in the Indiana Waste Exchange Catalog, prepared by Environmental Quality Control, Inc., under contract to the Indiana Department of Environmental Management. In addition, the Office of the Governor provides annual awards to private industries that have made outstanding progress in voluntary waste minimization.

The State has commenced efforts to build a library of waste reduction case histories. Indiana is also planning to adopt a waste minimization policy. Although waste minimization is a high priority in Indiana, continued efforts will depend on Federal and local funding.

Michigan

Michigan State statutes enacted in December 1987 created a Waste Reduction Assistance Service, an Environmental Technology Board, and an Office of Waste Reduction, each charged with furthering specific waste reduction needs. The Waste Reduction Assistance Service will provide educational services and onsite technical assistance to help firms identify and implement waste reduction practices. The Environmental Technology Board will report to the Governor and Legislature by June 1989 on methods in which the State can better support research needs in the field of waste reduction. The Office of Waste Reduction will focus its efforts on identifying regulatory barriers to waste reduction, recommending how waste reduction might be encouraged through existing regulatory programs, and analyzing waste reduction potentials and accomplishments in various industrial sectors.

All three programs, which became operational in late 1988, have a multimedia focus. While the responsibilities are officially housed in two separate departments (the Department of Commerce and the Department of Natural Resources), they are expected to be managed as a "joint venture" between the departments, with a shared budget of approximately $450,000 and four or five full-time personnel. Future program activities include public information and education, onsite technical assistance, analysis of waste reduction potential, and identification of regulatory barriers to waste reduction.

Current Michigan law does not mandate waste reduction, but it is encouraged through the above programs and through a hazardous waste landfill disposal fee and credit system. Through this system, firms may receive a refund of landfill fee payments upon documenting reductions in the volume of waste generated due to implementation of source reduction practices.

Minnesota

The State of Minnesota enacted a Waste Management Act that encourages waste reduction, processing, treatment, separation, and resource recovery. Waste minimization responsibilities are divided between the State Planning Agency (SPA) and the Minnesota Pollution Control Agency (MPCA). The SPA has planning authority in the area of solid and hazardous waste. The MPCA develops hazardous waste regulations.

The SPA funds the Minnesota Technical Assistance Program (MnTAP) at the University of Minnesota. MnTAP is a State program that performs confidential onsite consultations, manages a resource information clearinghouse, administers a student intern program, and offers research awards for minimization projects. The program also publishes a quarterly newsletter and has published several industry case studies.

The SPA and MPCA plan to share funds received from the recently awarded RITTA grant. The State will implement a State action plan, a RCRA training program, and a pilot project. The pilot project will focus on reducing the volume of the State's solvent waste stream in a variety of industries. Activities will include providing a public outreach program, conducting seminars and workshops, performing onsite audits, implementing a telephone hotline, and publishing a newsletter. The project is intended to encourage industries to voluntarily utilize waste minimization techniques.

New York

The New York State Department of Environmental Conservation (NYSDEC) encourages waste minimization through the Bureau of Hazardous Waste Program Development. The Waste Reduction Implementation Section within the Bureau is developing regulations, implementing source reduction policies, developing public outreach programs, publishing manuals and fact sheets, sponsoring conferences and workshops, and applying for Federal grants. The Waste Reduction Evaluation Section will be reviewing and evaluating waste reduction impact statements, inspecting facilities, developing a computer-based information system, assessing incentives and disincentives for waste minimization, and preparing waste reduction forms. The NYSDEC has formed an intra-agency task group to develop a uniform, multimedia approach to waste minimization. The NYSDEC also provides funds to the New York Center of Hazardous Waste Research for research in new technology areas, Superfund cleanup efforts, and hazardous waste reduction.

The State established a preferred waste management hierarchy in August 1987. In addition, the NYSDEC issued an organization and delegation memorandum directing each division director to consider utilization of a Waste Reduction Impact Statement to analyze the potential for reducing the generation and/or toxicity or hazardous waste across all media.

The Waste Reduction Sections are currently conducting two major projects. The first project is a hazardous waste reduction guidance manual that will promote the State's waste management hierarchy, provide a measure for waste reduction efforts, and help ensure that the State has adequate hazardous waste disposal capacity over the next 10 years. An additional component is two sets of workshops. The first set will solicit industry's comments on the guidance manual, and the second set will educate industries on the techniques described in the manual. The second project will provide an update of the hazardous waste treatment needs survey for the State. The project will forecast hazardous waste generation and gather information on future hazardous waste reduction opportunities.

The State imposes regulatory and Superfund fees on hazardous waste generators and facilities designed to encourage "preferred" waste management practices. In addition, pending legislation addresses waste minimization plans for hazardous waste generation.

The Environmental Facilities Corporation (EFC), a public benefit corporation established by New York in 1970, is also involved in waste management efforts. Among other duties, EFC conducts onsite industry audits for small quantity generators (SQGs). Under the Industrial Recycling Act, some of the confidential audits are free.

Other EFC responsibilities include financing of environmental projects for industry; providing technical assistance, an advisory service, and inactive hazardous waste site remediation; and financing an information clearinghouse. The EFC also helps to fund the Northeast Industrial Waste Exchange.

The Department of Environment and Planning in Erie County conducts an additional waste reduction program of its own that focuses on SQGs. The County operates a technical assistance and educational program that includes onsite consultations and an information clearinghouse. In addition, the County has published several industry specific small quantity hazardous waste generator guidebooks, has sponsored several hazardous waste minimization workshops, and publishes a quarterly newsletter.

Ohio

Ohio's efforts related to hazardous waste reduction and/or minimization are conducted by two agencies: the Ohio EPA, Division of Solid and Hazardous Waste Management, and the Ohio Department of Development, Ohio Technology Transfer Organization (OTTO).

The Ohio EPA has sponsored Ohio's participation in the Northeast Industrial Waste Exchange since 1983; requires waste minimization plans when reviewing applications for land disposal in Ohio; sponsors and participates in waste minimization seminars; sponsors annual Governor's Awards for Outstanding Achievement in Waste Management and Pollution Control, which includes waste minimization candidates; participates in a Hazardous Waste Minimization Task Force to advise the State of Ohio on appropriate government actions; and offers daily technical assistance and regulatory interpretation related to waste minimization. These activities are funded by Federal and State sources as part of the general hazardous waste management program.

The Ohio EPA requires waste minimization to be addressed as part of the conditions for land disposal of hazardous waste. This requirement applies to all generators proposing to dispose of more than 200 tons per year in an Ohio land disposal facility. Such generators must address waste minimization or lose their disposal approval. Disposal may also be denied upon the initial request for disposal approval.

OTTO provides technical assistance and oversees technology transfer related to waste minimization. OTTO is composed of a network of 32 field agents working at 5 universities and 23 technical and community colleges in Ohio. These agents acquire the technical expertise from academic institutions, State and Federal agencies, and other public and private resources associated with Ohio's business and industrial sectors. Although OTTO's responsibilities address a broad spectrum of business issues, this non-regulatory organization is the mechanism for technical assistance in waste minimization.

Specifically, OTTO conducts waste minimization seminars and provides site-specific technical assistance on effective waste minimization practices. In addition, OTTO agents will either train employees themselves or locate the appropriate experts to provide training and introduce new technologies. Ohio EPA was recently awarded a RITTA grant and will be formalizing its coordination with OTTO in an expansion of the State's waste minimization program. The Great Lakes Rural Network, located in Fremont, Ohio, is also working with OTTO to expand the technical assistance program, including that under RITTA. The OTTO program would include:

- Establishing a waste minimization training program for industry, agency staff, and local officials
- Providing site-specific technical assistance
- Continuing to conduct outreach seminars through Ohio EPA and OTTO, including technical assistance and referrals
- Surveying the business community to assess waste minimization information needs
- Publishing waste minimization manuals that target specific industries (yet to be determined)
- Publishing articles on waste minimization practices and potential savings
- Producing a quarterly newsletter that will be provided free of charge to Ohio businesses for the first year
- Conducting technology transfer workshops
- Coordinating a waste minimization trade fair, during which Ohio businesses can exhibit waste minimization and management products
- Providing speakers for waste minimization lectures.

Pennsylvania

In Pennsylvania, waste minimization has currently been reorganized under the Department of Environmental Resources as the Division of Waste Minimization and Planning. The Division is divided into three sections: municipal waste planning, waste minimization (which encompasses municipal to hazardous waste), and information management systems (which manages data for solid waste facilities). Pennsylvania currently has no waste minimization legislation, but the State does encourage waste minimization through research funding and fees for waste disposal facilities. In addition, the Hazardous Waste Facilities Plan, published in 1986, emphasizes source reduction as the primary waste management technique and reclamation of waste as a secondary alternative. A Hazardous Waste Minimization Act is now pending.

The State helps to fund the Center for Hazardous Materials Research (CHMR), a nonprofit subsidiary of the University of Pittsburgh Trust. The Center provides technical assistance through a hazardous materials hotline, seminars, workshops, training courses, onsite consultations, publications, and a quarterly newsletter. CHMR focuses on providing technical assistance to small business, industry, and government, as well as providing hazardous materials worker training, pesticide research, and education. The Center has published the "Hazardous Waste Minimization Manual for Small Quantity Generators."

The State also contributes to the Pennsylvania Technical Assistance Program (PENNTAP) at Pennsylvania State University. PENNTAP, founded in 1965, focuses on technology transfer by responding to questions from industries and municipalities and by distributing new information through workshops and consultations. PENNTAP also conducts confidential onsite audits of industries on their request. The president of Pennsylvania State University appoints an advisory council of industrial executives to discuss current and future policy decisions. PENNTAP has a special task force for hazardous and solid waste.

Pennsylvania initiated a Governor's Waste Minimization Award in 1987. The award program is open to individuals, companies, institutions, and government agencies in the State who have established innovative waste minimization projects. The annual award is given in two categories: industrial and municipal waste management. The criteria for selection include environmental benefits through waste minimization achievements, technological/management innovation, economic benefit, dissemination of innovative techniques, and commitment to environmental compliance. Summaries of successful projects are published to help publicize waste minimization as an alternative to disposal or treatment.

Wisconsin

Wisconsin's Department of Natural Resources (DNR) has a comprehensive solid waste minimization program in place. The Waste Reduction and Recycling Program provides information and education, technical assistance, financial assistance, and regulatory compliance assistance to the RCRA-regulated community. Wisconsin has done little to minimize the production of waste, but has a comprehensive program for minimizing the landfilling of waste. As a result of these solid waste minimization activities, Wisconsin's DNR has compiled an extensive publications list regarding recycling and resource recovery technologies. The State is now turning its attention to hazardous waste minimization and has recently been awarded a RITTA grant to facilitate the effort. Hazardous waste minimization program efforts will include:

- Conducting site-specific waste audits
- Sponsoring industry-specific seminars
- Developing process-specific workshops
- Establishing a waste reduction information clearinghouse pertinent to Wisconsin's regulated community.

Local Programs

Many communities, some with the encouragement and assistance of local industries, are providing for the collection and proper disposal of household hazardous wastes, ranging from old containers of pesticides to paint, paint thinners, and waste oil. For example, in recent years Dow Chemical Company's facility in Midland, Michigan, has sponsored an annual household hazardous waste disposal week for area residents.

TOXICITY REDUCTION ACTIVITIES

Toxicity reduction activities center largely on the National Pollutant Discharge Elimination System (NPDES) Pretreatment Program and the inclusion of Toxicity Reduction Evaluations (TREs) in select NPDES permit requirements.

Pretreatment Program

A Pretreatment Program is required for all municipal wastewater plants treating significant quantities of industrial process wastewaters. The Pretreatment Program Plan for each city is approved by the USEPA or the delegated State and implemented by the State via wastewater discharge permit requirements of the NPDES permit. Each major industrial contributor must install, operate, and maintain treatment equipment capable of removing select Priority Pollutants to a degree specified for its industrial category(ies) by the Best Available Technology (BAT) Economically Achievable guidelines or local limits set by the discharger. In most cases in Region V, local limits are more stringent than BAT guidelines. Full implementation of the Pretreatment Program will have the effect of reducing not only the volume of municipal sludge containing hazardous quantities of toxic substances, but also the toxic contaminant concentrations in wastewater discharges.

To facilitate Pretreatment Program implementation, USEPA continues to sponsor technology transfer workshops for State and local regulators and publicly owned treatment works operators. In November 1987, USEPA published its Guidance Manual for the Implementation of Local Discharge Limitations Under the Pretreatment Program.

Once the program is fully successful, one of the original intents of the Water Pollution Control Act Amendments of 1972 will have been fulfilled: to restore municipal sludge quality to the point where it can be used as a soil amendment on agriculture, silviculture, and horticulture without unacceptable risks to the public health or the environment. When this occurs, significant sources of pollution associated with dewatering and disposal or incineration of contaminated municipal sludge will have been virtually eliminated while maximizing the benefits associated with nutrients recycling.

Toxicity Reduction Evaluations

With the publication of USEPA's Technical Support Document for Water Quality-Based Toxics Control in September 1985, whole effluent toxicity as a component of the NPDES permit program added a major tool to EPA and the States' abilities to control toxics.

The number of Great Lakes Basin permits with whole effluent toxicity monitoring and limitations continues to grow as NPDES permits are re-issued. These limits vary from restrictions on end-of-the-pipe acute toxicity to chronic toxicity limits of the low flow in-stream waste concentration to back-to-back flow-through chronic toxicity tests.

When whole effluent toxicity limits are in permits and the discharger has problems meeting those limits, it is often necessary for the discharger to reduce whole effluent toxicity in a systematic fashion. USEPA developed two approaches to conducting TREs to identify and reduce the source(s) of toxicity in the discharged effluent.

A TRE is conducted if an unacceptable level of toxicity is detected in short-term (acute) or long-term (chronic) tests using sensitive indicator organisms with a reproducible response. If the toxic component or components and their sources can be readily identified, improved housekeeping, chemical substitution, process modification, or wastestream pretreatment can be instituted to reduce the toxicity below unacceptable levels. If the cause(s) and source(s) of the toxicity are not obvious, a more sophisticated TRE procedure can be used that involves fractionation of the wastewater to isolate the toxic fractions. Once toxic components are isolated, source reduction efforts can be targeted at the most significant sources of the problem pollutants amenable to improved housekeeping, chemical substitution, process modification, or wastestream pretreatment.

In 1987, USEPA published a TRE Implementation Guidance Manual to facilitate implementation of toxicity-based effluent limitations and toxicity reduction permit requirements.

A companion volume is being developed to provide further standardization and quality assurance/quality control of toxicity testing methods used in the TRE program.

GLNPO has contributed to the body of methodologies available for implementing toxicity reduction in wastewaters with the development of a Process Characterization Users Manual. Although targeted to a chemical-by-chemical approach to effluent monitoring and limitations requirements development, the same methodology can be applied to chemical substitution, process modification, or wastestream pretreatment goals. The Manual is in the final stages of completion.

ANNEX 13: POLLUTION FROM NONPOINT SOURCES

INTRODUCTION

Annex 13 mandates a number of measures to address nonpoint sources of pollution from land-use activities in the Great Lakes Basin. These measures specifically encompass efforts to further reduce nonpoint sources of phosphorus, sediments, toxic substances, and microbiological contaminants that drain into Lake waters from surrounding urban and rural lands, including waste disposal sites. Under this Annex, the Parties are required to identify land-based activities that contribute to the water quality problems described in Remedial Action Plans (RAPs) for Areas of Concern (AOCs) or in Lakewide Management Plans (LMPs) (under Annex 2), and to develop and implement watershed management plans that will reduce nonpoint source inputs to priority hydrologic units.

The Parties must also identify, preserve, and rehabilitate (where necessary) significant wetland areas that are threatened by urban and agricultural development and waste disposal activities, determine nonpoint source pollutant inputs in order to estimate loadings to Great Lakes boundary waters, and identify the extent of change in land use and land management practices that significantly affect water quality in order to track the effects of remedial measures.

Finally, Annex 13 requires the Parties to report biennially on progress in developing specific watershed management plans and implementing programs and measures to control nonpoint sources of pollution.

Historically, the primary U.S. activities to identify and control nonpoint sources of pollution in the Great Lakes have focused on reducing the phosphorus load to the Lower Lakes (Lakes Ontario and Erie) and to the eutrophic embayments (Green Bay in Lake Michigan and Saginaw Bay in Lake Huron). However, in addition to recent efforts led by the USEPA to meet the requirements of Annex 13, a variety of programs at both State and Federal levels (including Department of Agriculture's Soil Conservation Service, Department of the Interior's Fish and Wildlife Service, and State Coastal Zone Management programs) also address nonpoint issues such as soil erosion, construction site runoff, and wetland protection on an ongoing basis. Often these efforts are conducted in cooperation with USEPA. These and more recent strategies for meeting the requirements of Annex 13, such as nonpoint source assessments and management programs under the Amendments to the Clean Water Act (CWA), are briefly discussed in this section.

PHOSPHORUS REDUCTION PROGRAMS

Annex 3 of the GLWQA sets forth a general framework for Canada and the United States to reduce phosphorus loadings to the Great Lakes. In 1983, a Supplement to Annex 3 was approved, delineating phosphorus loading levels to be achieved by 1990, and restating the belief that phosphorus loading objectives could be attained through existing programs in the Upper Lakes.

Additional action was required to obtain target loads for Lake Erie, Saginaw Bay, and Lake Ontario, however. Consequently, the 1987 revisions to the GLWQA modified the reductions needed for Lake Ontario, based on new analyses. In setting these load reduction requirements, the GLWQA recognized that nonpoint source controls on phosphorus, particularly from agricultural activities, would be required to meet Agreement goals. To achieve these target goals, each State and Province was required to develop and implement a detailed phosphorus load reduction plan for these Lakes. The last State Plan was completed in September 1986.

In 1986, the Great Lakes Phosphorus Task Force (representing the States of Indiana, Michigan, New York, Ohio, Pennsylvania; the Soil Conservation Service, Agricultural Stabilization and Conservation Service, and Cooperative Extension Services of the U.S. Department of Agriculture (USDA); and the USEPA Regions II, III, and V, as well as GLNPO), allocated Lake Erie target load reductions among each responsible State. In addition, Michigan and New York were assigned a target load reduction for Saginaw Bay and Lake Ontario, respectively. The nonpoint source pollution abatement components were based upon obtaining new funds to support an accelerated effort that would meet the 1990 goal.

This phosphorus load reduction strategy evolved from the cooperative efforts of USEPA, USDA, and the States to conduct demonstration programs, public outreach efforts, and other projects to promote the use of conservation tillage, animal waste, and fertilizer management techniques by farmers throughout the Great Lakes Basin. As part of these activities, under an Interagency Agreement with the USDA Soil Conservation Service, USEPA is conducting a 3-year project to track conservation tillage practices using highway transects and remote sensing techniques in 58 counties in Indiana, Michigan, and Ohio. The study has provided an estimate of phosphorus load reductions that would be achieved as a result of expanding the use of conservation tillage. A special study was also carried out in Ohio, an area where nonpoint phosphorus discharges are particularly high because of regional conditions.

These studies indicated that USDA programs would have to be expanded in Ohio, Pennsylvania, and New York in order to decrease nonpoint source phosphorus loads sufficiently by 1990 to meet the Agreement goal. Based on the allocated load reductions and State plans to comply with the allocations, the nonpoint source components of required load reductions have been isolated and tracked. For each State, the majority of the nonpoint source load reduction was expected to come from agricultural sources. Although increased attention has been paid to encouraging the agricultural communities in these States to adopt conservation tillage and animal waste management activities, program expansion has not occurred to an appreciable degree. Thus, the States are generally behind schedule in reducing nonpoint source phosphorus loads.

The 1990 target load reductions for Lake Erie, Lake Ontario, and Saginaw Bay are compared with load reductions achieved by 1988 in Table 3. New York has already made substantial progress reducing nonpoint source phosphorus loads to Lake Ontario, achieving more than 45 percent of the targeted load reduction goal. Similarly, Michigan has attained more than 90 percent of its load reduction goal for Saginaw Bay and an acceptable 25-percent reduction for Lake Erie. Phosphorus load reductions to Saginaw Bay and Lakes Erie and Ontario as of 1988 were 207.8, 330.2, and 105.5 metric tons, respectively. Although these reductions were significant, given that they were achieved with existing programs and competing priorities, the apparent success must be tempered by the realization that 1988 was a drought year, resulting in reduced land runoff. In any case, the reductions fall short of meeting the 1990 goals.

TABLE 3. SUMMARY OF THE 1990 PHOSPHORUS LOAD REDUCTION GOALS FOR LAKE ERIE, LAKE ONTARIO, AND SAGINAW BAY AS COMPARED TO 1988 REDUCTION IN PHOSPHORUS LOADS (METRIC TONS)

	Units of Measure
Lake Erie	
1990 Goal	1700
1988 Reductions	330
Reduction Needed to Meet 1990 Goal	1370
Lake Ontario	
1990 Goal	235
1988 Reductions	106
Reduction Needed to Meet 1990 Goal	129
Saginaw Bay	
1990 Goal	225
1988 Reductions	208
Reduction Needed to Meet 1990 Goal	17

MANAGEMENT PLANS TO CONTROL TOXIC LOADINGS FROM NONPOINT SOURCES

In FY 1988, GLNPO sponsored a workshop on developing lakewide management plans for State agencies in the Great Lakes Basin. This workshop was the first step toward fulfilling the requirements of the GLWQA for controlling toxic pollution from nonpoint sources.

RAPs for AOCs and LMPs (both required by Annex 2) also provide opportunities to focus on nonpoint sources of toxic loadings. In particular, the USEPA, Environment Canada, New York Department of Environmental Conservation, and the Ontario Ministry of the Environment have committed to developing a LMP for Lake Ontario to control toxic loadings. Because of the importance of leachates from land disposal sites in the drainage basin, significant aspects of this plan will be directed toward nonpoint sources. The Lake Ontario Toxics Management Plan will be completed in February 1989.

In 1986, USEPA and the States of Illinois, Indiana, and Michigan prepared a Lake Michigan Toxic Pollutant Control/Reduction Strategy. The objective of the strategy is to restore multiple human uses to Lake Michigan and to protect human health and the Lake Michigan ecosystem by achieving a significant reduction in the loading rates of toxic pollutants. The strategy will use a whole-lake mass balance approach to modeling toxic pollutants and evaluating potential regulatory controls.

The Great Lakes States also have worked jointly towards achieving the goals of the GLWQA. In June 1986, the Governors of the eight Great Lakes States signed the Great Lakes Toxic Substances Control Agreement. This Agreement pledges the States to treat the Lakes as a single ecosystem despite political boundaries, acknowledges that toxic pollutants are the foremost problem to be addressed, and lays out goals for the States. More recently, the Governors agreed to establish a permanent fund for Great Lakes studies. Many of the activities under both of these State agreements will lead directly and indirectly to the completion and implementation of management plans and ultimately to the attainment of the Agreement objectives. Considerable progress has been made toward this goal by USEPA Headquarters and regional regulatory and remedial programs by the States.

In FY 1989, USEPA will continue to characterize the extent of nonpoint sources of toxic pollution and identify opportunities for conducting demonstration projects to assist with programs for conventional pollutants.

1987 AMENDMENTS TO THE CLEAN WATER ACT -- STATE NONPOINT SOURCE ASSESSMENTS AND MANAGEMENT PROGRAMS

Other recent U.S. efforts to identify and control nonpoint sources of pollution are derived from Section 319 of the CWA, as amended in 1987. Under this Section, each State was required to develop a Nonpoint Source Assessment. Having accomplished this, the Great Lakes States are now developing Nonpoint Source Management Program Plans. The assessments are intended to determine the waters of each State that will not meet designated uses due to nonpoint source inputs, to identify the categories and subcategories of nonpoint sources that contribute to water quality degradation, and to describe existing programs designated to control each category and subcategory. Many programs are required to address all the categories and subcategories of nonpoint sources identified in assessment reports as causing water quality impairments. In addition, programs must include an identification of implementation strategies as well as milestones and schedules for remedial activities.

Consistent with Annex 13 and Clean Water Act requirements, USEPA issued guidance to the States encouraging the use of a watershed approach in developing these management programs, with areas designated as AOCs receiving priority attention.

The federal government provided limited funding for assessment and management program development under Section 205(j)(5) of the Act. Although use of these funds was optional, all of the Great Lakes States availed themselves of these additional resources, and have prepared draft assessments and programs that are currently under by USEPA review.

The draft nonpoint source management programs cover a wide range of control activities, including those for nutrients (particularly phosphorus), and sediment pollutants. Significant gaps in this effort remain, however, as most States have not had the time or the resources to fully develop all aspects of their programs. Over the next year, additional effort will be made to more fully develop the State management programs. Once the programs are completed, Congress may allocate funds under Section 319 of the Act to assist in program implementation. Additional funds will be needed for States to meet the agreed phosphorus load reductions, regardless of the amounts needed for toxics controls that may be part of their nonpoint source management programs under the CWA.

USEPA's Office of Groundwater Protection, in coordination with USEPA's Nonpoint Sources Branch and GLNPO, is initiating a project to examine and refine methods to quantify nonpoint source contamination of groundwater discharge to surface waters. These methods will ultimately assist the States in developing nonpoint source management programs where groundwater is a significant transport mechanism of nonpoint source pollution to surface waters.

OTHER ACTIVITIES

Because an important function of wetland areas is to act as a filter for nonpoint sources of pollution from upland, wetland protection is an important component of watershed management. The U.S. Army Corps of Engineers, in cooperation with the USEPA, administers a permit program under Section 404 of the Clean Water Act to regulate the dredging and filling activities in U.S. waters, including wetlands. In 1988, the number of dredge and fill permits issued in the Great Lake States declined 19.5 percent from 1987, with a total of over 680 standard permits.

Other efforts to protect wetlands include the advanced identification (ADID) of significant wetlands, which assists in determining wetland areas that are unsuitable for filling. In Region V, four ADID studies have been completed, involving over 2,500 acres of wetlands. The study areas include the Grand Calumet River/Indiana Harbor Canal, Indiana; Lake County, Illinois; Green Bay, Wisconsin; and Lake Calumet, Illinois.

The National Oceanic and Atmospheric Administration (NOAA) currently oversees and supports approved coastal zone management (CZM) programs in four of the Great Lakes States. These State programs address not only wetlands protection, but also land use, energy facility siting, and other activities affecting the wetlands and coastal areas. CZM programs are particularly important as regulatory mechanisms for controlling upland activities that contribute to nonpoint source discharges. Federal activities that affect the coastal zones of these States must be certified by the State as consistent with its CZM program.

Another example of recent State activities in nonpoint source programs is Minnesota's Clean Water Partnership Program, established in 1987. This program's goal is to protect and improve surface and ground water in the State through financial and technical assistance to local governments. The Program focuses primarily on water pollution associated with land management activities.

NOAA also has a diverse research and monitoring program addressing nonpoint source pollutants ranging from collecting data on inputs, transport, fate, and effects of pollutants to studies on the interactions of these pollutants with the marine environment. NOAA research is conducted and/or supported through its National Sea Grant College Program and its Great Lakes Environmental Research Laboratory (GLERL).

GLERL supports a small project in cooperation with the Soil Conservation Service of the USDA and several State agencies on the effectiveness of Best Management Practices (BMPs) implemented as part of the Saline River Rural Clean Water Project for the reduction of major nutrients and sediments to the small streams in the basin. This project is intended to assist in providing estimates of loadings of nutrients to the boundary waters, and also serves as a demonstration project on the importance of land-use and land management practices that affect water quality.

Demonstration projects for nonpoint source pollution control techniques have had many successes in the Great Lakes, over the years. In 1972, Section 108(a) of the CWA authorized $20 million for USEPA to demonstrate the engineering and economic feasibility of pollution control in the Great Lakes Basin. GLNPO worked closely with USEPA's Office of Research and Development, Headquarters and regional water program, as well as with State and local government organizations, to conduct demonstration programs that covered a range of objectives, including demonstrating specific control technologies, controlling agricultural pollution through BMPs, increasing public awareness of water pollution issues, documenting water quality results through monitoring, evaluating combined sewer systems, and evaluating various sewage land application techniques.

Management projects conducted under the Section 108(a) program included development of a watershed management computer model for identifying important pollution sources, model ordinances for pollution control, and other management tools. Other projects involved demonstrating sewage sludge land application techniques and conservation tillage practices. A key aspect of the tillage demonstration projects was that by providing funding and technical assistance to local soil and water conservation districts, tremendous amounts of local support was developed. Thus, these projects have provided important institutional and technical insights beneficial to State and local programs.

The USDA also supports demonstration programs that address nonpoint sources of pollutants, including the USDA/Agricultural Stabilization and Conservation Service-sponsored

Rural Clean Water Program. The goal of this program is to develop agricultural BMPs by providing technical and financial assistance to farmers for nonpoint source pollution control.

Similarly, the USEPA Nationwide Urban Runoff Program has funded demonstration projects focused on an evaluation of the effectiveness of alternative nonpoint source pollution control techniques. USEPA will continue to sponsor nonpoint source demonstration projects to ensure that the reductions in phosphorus discharges already achieved in the basin are maintained. If ongoing evaluations show that more controls are necessary, USEPA will work towards further reductions through new demonstration and public education projects.

A new program for permitting stormwater discharges, which is being developed by the USEPA under Section 402(p)(2)(E) of the Clean Water Act, provides an additional mechanism for controlling pollutants contained in urban runoff.

ANNEX 14: CONTAMINATED SEDIMENT

INTRODUCTION

Annex 14 requires the Parties, in cooperation with State and Provincial governments, to identify the nature and extent of sediment pollution of the Great Lakes system. Based on these findings, methods will be developed to evaluate both the impact of polluted sediments on the Great Lakes and the technological capabilities of programs to remedy such pollution.

This report describes progress made by the United States to fulfill its responsibilities under Annex 14. After a brief overview of U.S. sediment activities, progress is described in three general areas: surveillance programs, technology programs, and long-term control measures.

Overview of U.S. Contaminated Sediment Activities

U.S. activities related to contaminated sediment are implemented under Sections 118(c), Section 404, and Section 401 of the Clean Water Act (CWA) and the GLWQA.

Section 118(c)(3) of the CWA requires USEPA to carry out a 5-year study and demonstration program for the control and removal of toxic pollutants from the Great Lakes. The CWA specifically designates five AOCs for "priority consideration" in locating demonstration sites: Saginaw Bay, Michigan; Sheboygan Harbor, Wisconsin; Grand Calumet River, Indiana; Ashtabula River, Ohio; and Buffalo River, New York.

It should be noted that both Annex 14 and Section 118(c)(3) of the 1987 Amendments to the CWA represent a new direction in contaminated sediment management. Both the Agreement and the Act directly address the problem of contaminated sediments outside the context of navigational dredging and dredged material disposal. Concern is now focused on situations where contaminated sediments, if left in place, present risks to humans and the ecosystem through contaminant mobility or bioaccumulation. (Annex 7 of the GLWQA deals further with issues related to navigational dredging.)

Section 404 of the CWA provides for the regulation of discharges of dredged or fill material into all U.S. waters. The U.S. Army Corps of Engineers (USCOE), in cooperation with the USEPA, administers the Section 404 permit program. Michigan is the only Great Lake State that has assumed the administration of the Section 404 permit program for selected waters in the State. The USCOE retains jurisdiction of navigable waters and adjacent wetlands and regulates all U.S. waters in the absence of an approved State program. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) review and comment on 404 permit applications and provide technical assistance to protect fish and wildlife resources and to mitigate project impacts.

Worst cases of contaminated sediments are located in the designated Areas of Concern (AOCs). Of the total 42 in the United States and Canada, 41 AOCs have contaminated sediments that are impairing beneficial uses. Preparation of Remedial Action Plans (RAPs) are under way in all 30 U.S. AOCs and will address contaminated sediments.

COORDINATION OF RESEARCH AND OTHER STUDIES

In FY 1988, GLNPO started work to improve its coordination procedures within EPA and with other Federal Agencies and the Great Lakes States. GLNPO established interagency agreements related to contaminated sediments with several other government offices and institutions. Within USEPA, GLNPO has also established agreements for participation by other EPA programs and offices in Great Lakes initiatives. For instance, GLNPO entered into agreements with the Office of Research and Development to fund Great Lakes work at the Environmental Research Laboratory - Duluth, Minnesota, and its Large Lakes Research Station (LLRS), Grosse Ile. These two laboratories are contributing substantially to the Green Bay/Fox River Mass Balance Study, demonstration projects undertaking research on contaminated sediment, and other GLNPO initiatives.

Also in FY 1988, GLNPO entered into an agreement with the Council of Great Lakes Governors to assist with implementation of the Great Lakes Toxic Substances Control Agreement, signed by the Governors in 1986. This Agreement pledges the States to treat the Lakes as a single ecosystem despite political boundaries, acknowledges that toxic pollutants are the foremost problem to be addressed, and lays out goals for the States. More recently, the Governors agreed to establish a permanent fund for Great Lakes studies. GLNPO plans to continue work on all of these efforts, as well as initiate new projects with State organizations in FY 1989.

During FY 1989, GLNPO established procedures for participating with EPA Headquarters in development of the Agency Operating Guidance for water programs and participated with regional water divisions in development of State water program guidance. These two guidance development activities are the principal methods by which EPA program priorities are communicated throughout the Agency and to the States. GLNPO plans to expand its efforts in this area to include participation in program guidance development for other EPA programs as well.

Overall, GLNPO has made important progress toward fulfilling obligations under both the CWA and the GLWQA. All of these achievements have involved other organizations working in the Great Lakes. By working cooperatively with the States and other Federal Agencies, GLNPO was able to ensure that significant progress toward achieving GLWQA goals was made during FY 1988. Much work remains to be done, however, and can be accomplished only through continued cooperative efforts throughout the Great Lakes Basin within the United States and with Canada. Future prospects focus primarily on control and abatement of toxic pollution in the Great Lakes.

SURVEILLANCE PROGRAMS

The progress of surveillance programs is discussed in three categories: classification of sediment quality, monitoring activities, and management of contaminated sediments.

Classification of Sediment Quality

Over the last several years, USEPA's Office of Water has examined ways to develop sediment quality criteria. The following approaches have been considered by USEPA in the course of this criteria development effort:

- Sediment toxicity tests -- safe sediment concentration of specific chemicals are established by a dose-response relation in sediment spike toxicity tests.
- Apparent effects threshold (AET) -- field data on biological effects are compared with sediment concentrations of individual chemicals. The AET is defined as the concentration above which biological effects are always observed.
- Equilibrium partitioning (EP) -- interstitial water concentrations are equated to water quality criteria concentrations for specific chemicals and used to calculate numerical bulk sediment criteria protective of aquatic life and its uses.
- Sediment quality triad -- correspondence between sediment chemistry, toxicity, and biological effects is used to determine sediment concentrations that discriminate conditions of minimal, uncertain, and major biological effects.

- Tissue residue approach -- safe sediment concentrations of specific chemicals are established by back-calculating from an acceptable tissue residue to the sediment concentration resulting in that residue.

- Reference approach -- frequency distributions of sediment chemical concentrations are established separately for reference (i.e., background) and contaminated sites, and compared with sediments of concern on a statistical basis.

- Extraction (elutriate) test -- contaminant concentrations in an elutriate from a 4:1 water/sediment mixture are compared with drinking or water quality criteria or various multiples thereof to protect the water column biota during dredged material disposal operations.

- Bulk sediment toxicity -- the toxicities of field-collected samples are determined by sediment bioassays.

All of these approaches have some history of application in other government programs. For example, the extraction test and reference approaches are being used in dredged material permit evaluations in many USEPA regions and the AET approach has been extensively applied in USEPA Region X. Additional work has been done by the Puget Sound Program to develop and test the sediment quality triad approach and AET method.

The Office of Water is working with several Regions and States on the national sediment criteria effort, which may include chemical specific methods for evaluating the effects of contaminated sediments (e.g., EP and AET) as well as non-chemical specific methods (e.g., biological community structure, and acute and chronic effects laboratory bioassays). Most of the methods alluded to in this section will be described in a Sediment Classification Methods Compendium currently under development by EPA, information will be presented on their advantages, limitations, and applications.

USEPA Region V is working with the States on methods to assess sediments through a draft In-Place Pollutants Control Initiative. In lieu of numerical sediment quality criteria derived in a manner consistent with that used for numerical water quality criteria, the present approach to classify contaminated sediment sites in the Great Lakes involves the application of the "Guidelines for the Pollution Classification of Great Lakes Harbor Sediments" developed by USEPA Region V. First published in 1968, these interim guidelines evolved from studies of Great Lakes harbor sediments started in 1967 by the Federal Water Pollution Control Administration. Those studies established three broad categories of sediment contamination based on field observations and professional judgment: nonpolluted, moderately polluted, and heavily polluted. Factors considered included color, odor, particle size distribution, presence of oil, and the condition of the benthic faunal community. Natural breakpoints in the sediment contaminant level data for samples from over 100 different Great Lakes harbors were then used to establish pollutant parameter concentration ranges corresponding to the observed conditions. Supplementary interim guidelines for 11 additional parameters were added in 1977, based on data from 260 samples collected at 34 harbors. These guidelines are used to determine if open lake disposal of dredged sediments is appropriate.

The Great Lakes Water Quality Board of the IJC, through its Dredging Subcommittee, also published Dredged Material Disposal Guidelines in 1982. The guidelines are based on the concentrations of pollutants in the sediments of depositional zones of the Great Lakes, rather than on the concentrations of pollutants in the harbor sediments.

In addition, USEPA's Office of Research and Development is developing sediment bioassays and measures of benthic community structure to evaluate benthic ecosystem effects of specific chemicals in complex wastes and contaminated sediments.

Some States have developed their own classification system. The following describes each State's approach to sediment classification:

Illinois has developed a five-tier classification system of stream sediment quality based upon standard deviations for background levels. This system is currently used by Illinois monitoring programs to assess sediment quality.

Indiana uses bulk analysis to evaluate sediment samples. In order to assess the test results, Indiana has established background levels for each substance of interest. The background levels were established using data collected over several years from uncontaminated sites. The test results are compared with established background levels, with USEPA Guidelines for the Pollution Classification of Great Lakes Harbor Sediments and with Indiana water quality standards. PCBs are considered the contaminants of primary concern; 0.5-1.0 ppm total PCB, depending on the sediment type, is considered the maximum acceptable concentration. Sites with levels exceeding this limit may require sediment removal. Fish tissue samples remain the primary indicator of toxic contamination, however. If fish tissue samples collected from the sediment site do not show accumulation, it is unlikely that sediment will require removal.

In Michigan, Minnesota, and New York the choice of classification criteria is site-dependent, although the 1977 USEPA Guidelines for the Pollution Classification of Great Lakes Harbor Sediments are commonly used. Recently, Minnesota has also been using guidelines set by Wisconsin. Pennsylvania conducts assessments on a site-by-site basis, as it has no standardized assessment criteria for contaminated sediments.

New York attempts to link the sediment classification to actual use impairment within specific water bodies. New York State Department of Environmental Conservation is currently developing a technical guidance document for evaluation of water quality impacts during dredging operations.

Ohio uses criteria developed by Illinois to classify Ohio stream sediments. Since the Illinois criteria were developed for streams similar to those in Ohio, they are more applicable than the USEPA Great Lakes Harbor sediment guidelines. Ohio does continue to use the USEPA Great Lakes Harbor sediment guidelines for harbor areas (river mouths), however.

Wisconsin has developed a three-tiered sediment assessment scheme and has established sediment quality criteria. These criteria are based on background data from several sources. The background data for metals were collected from recent and 200-year-old Lake Michigan sediments, bluff material from Lake Michigan shorelines, and average concentrations of metals in surficial sediments from all the Great Lakes. Background levels for organics were also determined using data from surficial sediments from all the Great Lakes. Wisconsin has developed background criteria for metals, total PCBs, total tetrachlorodibenzodioxin (TCDD), total tetrachlorodibenzofuran (TCDF), selected pesticides, and oil and grease.

Monitoring Activities

The GLWQA, as amended in 1987, sets forth several monitoring and research programs. Specifically, the Agreement requires the establishment of monitoring and research programs in support of the Great Lakes International Surveillance Plan at a level sufficient to identify:

- Temporal and spatial trends in concentration of persistent toxic substances
- Impact of persistent toxic substances on the health of humans and the quality and health of living aquatic systems

- Sources of input of persistent toxic substances

- Presence of previously unidentified persistent toxic substan s.

The Agreement also stipulates that research should be int ified to determine the pathways, fate, and effects of toxic substances aimed at the protectio f human health, fishery resources, and wildlife of the Great Lakes Basin ecosystem. Researc should be conducted to determine:

- Significance of effects of persistent toxic substances on hur health and aquatic life

- Interactive effects of residues of toxic substances on aquati fe, wildlife, and human health

- Approaches to calculate acceptable loading rates for p istent toxic substances, especially those which, in part, are naturally occurring.

The following discussion of U.S. progress toward a comprehe ve monitoring program focuses on monitoring to determine the impact of contaminated sedi nts on the Great Lakes system and on monitoring to increase our understanding of the transf of contaminants to and from bottom sediments.

Ambient Monitoring and Assessment Activities

Some States in the Great Lakes Basin undertake sediment mon ring as part of specific remedial activities. In particular, Indiana and Michigan have identifi contaminated sediment sites near industrial discharge points requiring remedial action. Michig lso has performed some investigative monitoring at three contaminated sediment study sites.

GLNPO has conducted harbor and estuary sediment sampling identify toxic hot spots and to aid in the identification of areas that are contributing large amou s of toxics to the Lakes. Twenty-five harbors on Lakes Superior, Michigan, Erie, and O rio were sampled for conventional or priority pollutants in 1981 and 1982, including intensi ampling of the Buffalo and Niagara Rivers in 1981 and the Detroit River in 1982. The St awrence River and its tributaries were sampled in 1984.

GLNPO sampled 52 tributaries to the four upper Great Lakes c necting channels during 1985. The levels of contaminants in the sediments were compared ag st guidelines developed by USEPA, Ontario Ministry of the Environment, and the IJC. Ove contamination at each tributary to the connecting channels was evaluated relative to the levels metals, nutrients, total PCBs, pesticides, and other organic compounds. The evaluations allowe for the identification of tributaries that were substantial contributors of pollutants. In addition, er all comparisons were made among all of the connecting channels studied to assist GLNPO in p oritizing remedial action needs.

The binational Coordinating Committee on the Niagara River developed an ambient monitoring program evaluating upstream versus downstream water qual and pollutant loadings. The program presently measures 40 persistent toxic chemicals and has d ction levels low enough to evaluate the potential exceedances of chronic ambient water quality iteria.

Future plans extend sampling to sediments in the open waters of he Lakes to measure the distribution, storage, and fate of toxics in the ecosystem, beginning in ake Michigan in 1991. This sampling will provide a chronology of toxic inputs to the Lakes and ill support mass balance models for Critical Pollutants. Sampling will also support development Lakewide Management Plans as required by the GLWQA. GLNPO coordinates this work with th development of national sediment criteria and sediment contaminant cycling studies conducte by USEPA's Office of

Research and Development laboratory at Duluth, Minnesota, and its Large Lakes Research Station at Grosse Ile, Michigan.

USEPA also is working with the States and local agencies on sediment monitoring during the development of Remedial Action Plans for the Areas of Concern by the IJC.

The Great Lakes States are also performing general area sediment monitoring. These monitoring efforts are performed either in response to a specific problem or as part of the State's routine basin monitoring programs. Specific efforts are described in Table 4.

Activities to Quantify the Transfer of Contaminants from Sediments

In addressing the issue of contaminated sediment management in the Great Lakes, the Water Quality Board convened the Sediment Technical Oversight Committee, which is composed of technical experts within the region. The overall objective of this Committee is to identify, coordinate, and provide guidance on contaminated sediment activities. The Committee's research plan includes the implementation of the following activities over the next 5 years:

- Identification and detail of chemical specific and bulk sediment toxicity methods
- Development of benthic organism chronic toxicity, bioaccumulation, and carcinogenicity test methods
- Performance of an ecological assessment of known sediment activity of metal ions in pore water and its toxicity.

The USEPA Environmental Research Laboratory at Duluth, Minnesota, is involved in monitoring efforts at sediment contamination remediation sites. Recent studies at various sites have involved sediment transport and deposition studies, acute and chronic toxicity testing, physical characterization, chemical analyses, Ames testing, and carcinogenicity testing of the sediment.

Contaminated sediment monitoring is also an important element in the Green Bay Mass Balance Study. This Study, coordinated by USEPA and Wisconsin Department of Natural Resources, is intended to develop and test a modeling framework on sources, transport, and fate of toxic compounds in the Green Bay area. The study is intended to support regulatory activities within the study area and to serve as a pilot project for larger modeling studies.

The project began in 1987 with the development of a monitoring plan and the establishment of a quality assurance program for evaluating analytical and field methods to be employed. Field reconnaissance and sampling commenced the following year and will continue through 1989 to determine levels of selected contaminants (i.e., those known to present problems in the Great Lakes and which also serve as surrogates for larger classes of contaminants) in various compartments (i.e., atmosphere, water, sediment, biota) of the Green Bay ecosystem. The model will incorporate the following components:

- Comprehensive quantification of loads from all significant sources (e.g., atmosphere, tributaries, ground water, point, and nonpoint)
- Determination of the net rate of exchange of contaminants between environmental compartments (e.g., sediment, surface water, ground water, biota, and air)
- Net rate of exchange with Lake Michigan.

TABLE 4. SUMMARY OF STATE AMBIENT WATER AND SEDIMENT MONITORING PROGRAMS

Illinois

Stream sediment data are collected through two programs: the Ambient Water Quality Monitoring Network (AWQMN) and the Intensive River Basin Survey Program. The AWQMN provides background and trend information, as well as information on current conditions in specific streams. Intensive surveys are basin-specific, and provide surveillance information for response to known or suspected water quality problems. Lake sediment data are collected through the State's ambient lake monitoring program and intensive lake surveys.

Indiana

Indiana collects sediment quality data through its Toxics Monitoring Program. This program concentrates on analyzing fish tissue samples collected at the State's 21 CORE stations. Sediment samples are routinely collected at the CORE stations as well. Intensive surveys have also been conducted on several lakes, reservoirs and streams in Indiana. Through intensive surveys and special studies 33 streams and 62 lakes and reservoirs have been studied in the past 3 years.

Michigan

Field investigations, including sampling and analyzing sediment for historic and ongoing discharges, may be conducted when sediment contamination is suspected based on results of water quality monitoring programs.

Minnesota

Prior to 1980, sediment quality sampling was a component of routine water quality monitoring in Minnesota. In 1973, 1976, and 1979, sediment samples were collected at 19 fixed monitoring stations in the State. This was discontinued after 1979 because of the lack of an established framework for data assessment. Currently, stream sediment quality data are collected through intensive stream surveys only. The lake monitoring programs do not regularly include sediment quality analysis.

New York

Benthic macroinvertebrate and fish community assessments, along with sediment samples analyzed for PCBs, chlorinated pesticides, and priority pollutant metals, are used in conjunction with water column data to describe overall water quality conditions. Additionally, site specific investigations to assess sediment conditions have included sediment mapping, contaminant distribution and toxicity, bioavailability, and erodibility testing.

Ohio

Ohio selects several streams each year for intensive surveys. Surface water quality is tested and fish and benthic populations are sampled at each site. Fish tissue and sediment testing are done less regularly. Sediment tests are done when there is reason to believe that sediments may be contaminated. Roughly one third of the intensive survey sites throughout the State, or 60 sites, conduct sediment sampling each year.

Pennsylvania

When sediment contamination is suspected based on results of other investigations, detailed analysis may be undertaken, including sediment sampling to determine the extent and magnitude of the contamination.

Wisconsin

Contaminated sediments have been identified as one of six primary elements to be evaluated by monitoring programs. Monitoring of contaminated sediments is conducted under several programs, including basin assessments, special projects, Mississippi River monitoring, and specific response actions.

Analysis of field data, modeling, and interpretation are scheduled to begin in 1990. These activities will be guided by several specific objectives:

- Usefulness in predicting concentrations of key contaminants in fish to help determine cancer risks to human fish consumers
- Utility for USEPA and State in making regulatory decisions
- Applicability of the pilot study as a model for larger, lakewide studies.

The U.S. Fish and Wildlife Service also has been involved in general area sediment monitoring. The National Fisheries Center-Great Lakes has performed caged organism studies in and around sites with contaminated sediments in order to examine biomagnification and bioconcentration of the pollutants found in the sediments. Clipped wing duck studies at a confined disposal facility (CDF) suggest that birds, when confined to a CDF having aquatic systems in contaminated ponds, can accumulate considerable body burdens of contaminants such as PCBs. Other studies have focused on eagles because of their reduced reproduction in the Great Lakes area. These studies showed that eagles may be indirectly accumulating sediment contaminants through ingestion of prey organisms.

The National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory (GLERL) is continuing research important to the implementation of Annex 14. The research deals with measurement of the bioavailability and uptake of contaminants from sediments by Pontoporeia hovi and the incorporation of the results into contaminant behavior models. A major publication provides a synthesis of 5 years of studies on the bioaccumulation of PAH from sediments of P. hovi.

The GLERL HI-SED project made comparative studies of radionuclide inventories between 1972 and 1982 in Lake Michigan and between 1976 and 1982 in Lake Erie. These studies show the long-term process of particle associated tracers and contaminants focusing on sediment depositional basins. A model has been developed to interpret distributions of chlorinated organic compounds (e.g., PCBs and pesticides).

Management of Contaminated Sediments

The United States and Canada are working jointly to develop a standard approach for the management of contaminated sediments within the Great Lakes. The first draft of the report is currently being reviewed by Federal, State, and Provincial officials in both countries.

TECHNOLOGY PROGRAMS

Remediation Demonstration Program

Under Section 118(c)(3) of the CWA as amended by the Water Quality Act of 1987, GLNPO will conduct a 5-year study and demonstration project relating to the control and removal of toxic pollutants from bottom sediments. The geographic focus of this study, termed the Assessment and Remediation of Contaminated Sediments Study (ARCS), will be in several Great Lakes Areas of Concern. This program gives priority consideration to conducting demonstration projects at five Great Lakes locations: Saginaw Bay, Michigan; Sheboygan Harbor, Wisconsin; Grand Calumet River, Indiana; Ashtabula River, Ohio; and Buffalo River, New York. The program will be carried out jointly with GLNPO and other Federal, State, and local agencies. The final locations of the demonstration sites will be determined by matching technologies and site specific characteristics, including complementary activities by USEPA, States, and particularly by the USCOE. GLNPO has also entered into an agreement with the Illinois Natural History Survey for assistance in planning and designing ARCS.

An Activity Integration Committee (AIC) has been created for the ARCS program. The AIC will coordinate the ARCS program activities at the operational level. This Committee will be chaired by the chief of the Contaminated Sediments staff at GLNPO. The AIC chair will also be an *ex officio* member of, and report directly to, the management committee. The AIC will be responsible for the accomplishment of program tasks through its oversight of the scientific and technical Work Groups.

Accomplishments during FY 1988 include work on site selection criteria for the demonstration projects and work with USEPA's Office of Water on cleanup criteria for pollutants in sediment. Also in FY 1988, GLNPO entered into an interagency agreement with the Army to assist GLNPO in the development of an evaluation framework for in-place contaminated sediments, assessments of remedial strategies and associated technologies, and the assessment of the overall effectiveness and benefits of various procedures eliminating or reducing adverse impacts resulting from in-place contaminated sediments. The Chicago District of the USCOE has performed a study to characterize Indiana Harbor sediments and evaluate various disposal alternatives. The Chicago District is now completing investigations on a number of innovative treatment technologies. These include incineration, oxidation, extraction, and solidification. This study will rank alternatives according to technological feasibility, and will include detailed cost estimates.

Remediation Activities

Remediation programs are carried out by Federal, State, and local government organizations throughout the Great Lakes Basin, working under authorities granted by Federal and State environmental statutes.

To date, USEPA has had limited success in mitigating sediment contamination problems due to a number of factors. These include the lack of national guidelines for determining what levels of contaminated sediments cause problems, the problems and expense involved in dredging and disposal operations, and USEPA and USCOE limitations for management of contaminated sediments. Virtually the only ongoing effort to remove contaminated sediments in Region V is the USCOE dredging program. This program, however, is limited to dredging only where necessary for navigation purposes. As noted earlier, dredging for navigation purposes is addressed in Annex 7.

Another potential mechanism to remediate contaminated sediment problems is the Superfund program. However, sites with only contaminated sediment problems are not typically found to pose risks to human health severe enough for the sites to be ranked very high on the Hazard Ranking System (HRS) or placed on the National Priorities List (NPL). For sites on the NPL, sediments are not always remediated along with on-site media (soil, ground water) because of the lack of SQC, the difficulty in linking sediment contamination to a single site, and remediation/disposal difficulties and costs. Nevertheless, three contaminated sediment sites in the Great Lakes Basin are slated for Superfund cleanup: Waukegan Harbor, Illinois; Fields Brook, Ohio; and Sheboygan River, Wisconsin.

In Region V, the thrust of the sediment work has been on the Great Lakes. Two USEPA activities intended to remediate contaminated sediments in Great Lakes harbors and tributaries are the development of RAPs for 30 Areas of Concern and the 5-year demonstration program. GLNPO has provided technical support to all of the Great Lakes States in preparing the RAPs. Since virtually all of the AOCs have contaminated sediment problems, implementation of these RAPs will be a major step toward remediating Great Lakes sediments. While the above two activities relate solely to Great Lakes harbors and tributaries, the current In-Place Pollutant Strategy will emphasize inland waterways.

TABLE 5. STATE PROGRAMS FOR CLASSIFICATION AND DISPOSAL OF DREDGED SEDIMENT

APPLICABLE PROGRAMS	CRITERIA	DISPOSAL OPTIONS
Illinois		
Issuance of an Illinois Section 401 permit for a dredge project certifies that the dredging activity and associated disposal actions comply with Illinois water quality standards and laws. Federal 404 permits are also required for all dredge projects.	Sediment quality is determined through particle size analysis, then if necessary, supernatant or modified elutriate testing. The preferred method of sediment classification is comparison of the elutriate test results (based on dredging technique, disposal plans, and contaminants) to the water quality standards and effluent standards set by State Code.	The accepted means for disposal of dredge spoil in Illinois are Confied Disposal Facilities (CDFs), agricultural land nourishment, beach nourishment, open water disposal, and bank disposal. The latter two options apply only to material which is 80 percent or more sand.
Indiana		
Indiana monitors dredged sediment disposal through Section 401 of the Clean Water Act. Federal 404 dredge and fill permits are also required.	Sediment quality analysis is required if tissues from fish in the area exceed U.S. Food and Drug Administration (FDA) action levels. The USEPA "Interim Guidelines for Evaluation of Dredged Sediments" are used as a general guideline for evaluating bulk sediment test results, supplemented by Indiana water quality standards. Test results are also compared to background data compiled by Indiana through its monitoring programs.	Indiana water pollution control laws prohibit the disposal in State waters of any matter that may retard the growth of fish, vegetation, or other animal life. Based on these laws, open water disposal of dredged sediments is discouraged; however, open water disposal is allowed in certain instances as beach nourishment or rip rap. Upland disposal is subject to solid and hazardous waste regulations.

TABLE 5. STATE PROGRAMS FOR CLASSIFICATION AND DISPOSAL OF DREDGED SEDIMENT (CONTINUED)

APPLICABLE PROGRAMS	CRITERIA	DISPOSAL OPTIONS
Michigan		
Dredge and fill permits are required under Section 404 of the Clean Water Act, and under the Michigan Submerged Lands Act of 1955. Michigan maintains a Section 404 data base to catalog information affecting permit review. Characterization data are stored by township and section, and include factors such as contamination of bottom sediments, areas of severe coastal erosion, fish consumption advisories, and/or historic discharge information. For each dredge and fill permit application, a computer check determines which characteristics of the project site may warrant special attention. Thus, sediment data are generated as a result of the permit application process.	In cases where sediment analysis is required, bulk sediment testing is performed for those parameters deemed likely to be present based on historic data.	In most cases, historic data are used to determine whether the sediment is suitable for open water disposal. Permits for sites that require frequent and regular dredging are handled by the district USCOE field staff and do not require State referral.
Minnesota		
In Minnesota, dredging projects are regulated by the issuance of a State Disposal System permit, in addition to Federal 404 permits.	Secondary treatment, toxic effluent standards and water quality standards are applicable to each individual project. Variances from the standards or procedural requirements are granted on an individual basis.	All hydraulic dredging projects are usually required to obtain a state disposal system permit as there is potential for carriage water flow to contaminate ground or surface water. Flow from confined disposal facilities is monitored. If the history of the site gives reason to suspect contamination, and there is no existing sediment data, testing may be required.

TABLE 5. STATE PROGRAMS FOR CLASSIFICATION AND DISPOSAL OF DREDGED SEDIMENT (CONTINUED)

APPLICABLE PROGRAMS	CRITERIA	DISPOSAL OPTIONS
New York		
Section 401 permits are required for dredging projects to ensure consistency with New York programs, laws, and regulations. Federal 404 permits are also required.	There are no set criteria to classify sediment. Sediment are classified as either incidental to channel maintenance or those which pertain to water use impairments and hazards posed by contaminated sediments.	[No Information Available]
Ohio		
Issuance of a 401 permit is required for all dredging operations to ensure compliance with all Ohio programs, laws, and regulations. Federal 404 permits are also required.	If contamination is suspected, physical characterization, bulk and/or elutriate analyses are required. Sand and coarser sediments are considered uncontaminated, fine sediments require chemical analysis. Parameters are determined by the site history, using EPA guidelines for pollution classification. Bioassays are recommended to be coordinated with EPA.	[No Information Available]
Pennsylvania		
Issuance of a 401 Water Quality Certification for a dredging project in Pennsylvania certifies that the activity complies with relevant water quality standards. Federal 404 permits are also required.	The USCOE criteria are used to review the degree of contamination in determining appropriate disposal actions.	Most dredged sediments are disposed of on upland sites and are subject to Pennsylvania's solid and hazardous waste regulations. Existing Pennsylvania law allows open lake disposal depending upon the degree of contamination. Heavily contaminated dredged spoils are disposed of in confined disposal facilities (CDFs).

TABLE 5. STATE PROGRAMS FOR CLASSIFICATION AND DISPOSAL OF DREDGED SEDIMENT (CONTINUED)

APPLICABLE PROGRAMS	CRITERIA	DISPOSAL OPTIONS
Wisconsin		
Wisconsin has codified procedures for assessment and criteria for in-water or beach disposal of dredged sediments. This law is currently being redrafted to expand and clarify the review procedures. Federal 404 permits are also required.	Wisconsin currently applies a tiered assessment scheme in evaluating dredge project sites for regulatory, remedial, and monitoring activities. The initial assessment step is conducted using existing and readily accessible Wisconsin data or information submitted by the applicant. The second tier is establishing sampling and analysis requirements. Bulk chemistry analysis is performed on the samples to determine potential disposal methods. Background criteria are used to determine suitability for open-water disposal or beach nourishment. Open water disposal is only allowed by law if a beneficial use is derived. If the bulk chemistry criteria are exceeded, the applicant may enter the third tier of the assessment scheme--toxicity testing.	For any project where upland disposal is required or planned, assessment requirements are determined under the State solid waste program review. A new law has been proposed to define the requirements for in-water confined disposal facilities.

Table 6 lists State programs and projects, both underway and proposed, related to the remediation of sites with contaminated sediments.

TABLE 6. SUMMARY OF STATE PROGRAMS AND ACTIVITIES RELATED TO CONTAMINATED SEDIMENTS

PROGRAM	CURRENT PROJECTS	PROPOSED PROJECTS
Illinois		
The Clean Illinois program is in place to fund the cleanup of contaminated bottom sediments.	The Upper Waukegan Harbor is currently being investigated under USEPA Superfund authority and is the subject of litigation and negotiation between USEPA and Outboard Marine Corporation (OMC). Negotiations between EPA and OMC have resulted in a Consent Decree and recommended remedial alternatives to clean the OMC/Waukegan Harbor site. An estimated 1,100,000 pounds of PCB are contained in 220,000 cubic yards of sediment and soil. The USCOE is developing an Environmental Impact Statement (EIS) for dredging and disposal for the Lower Harbor adjacent to the area subject to Superfund action.	Once Superfund-related remedial actions have been planned, the Illinois USEPA will assess other actions required to satisfy the IJC requirements for RAP development.
Indiana		
A State bill has been drafted for a hazardous waste cleanup or "State Superfund" program. The proposed law outlines a program that is meant to complement the USEPA Superfund program.	Sediment data for the Grand Calumet River/Indiana Harbor Canal area have been collected by the USCOE, Indiana Department of Environmental Management (IDEM), and USEPA. Dredging of the Indiana Harbor Canal, has been delayed due to concerns over disposal methods for the PCB-contaminated dredged sediments.	
Michigan		
The Michigan Environmental Response Act (MERA) provides a method for identifying and assigning priority to sites of environmental concern within Michigan and conducting risk assessments.	Michigan DNR has submitted nine RAPs to the IJC which include remedial actions for contaminated sediments.	Michigan DNR is responsible for overseeing the development of one additional RAP.

TABLE 6. SUMMARY OF STATE PROGRAMS AND ACTIVITIES RELATED TO CONTAMINATED SEDIMENTS (CONTINUED)

PROGRAM	CURRENT PROJECTS	PROPOSED PROJECTS
Minnesota Under the Minnesota Environmental Response and Liability Act (MERLA) the Minnesota Pollution Control Agency (MPCA) has the authority to respond to the release of hazardous substances to the environment. MERLA ranks potential sites using the Federal Hazard Ranking System. Investigation at a potential site near any surface water body must include sediment quality analysis for contaminants of concern.	Sediment data collected by MPCA show the St. Louis Bay sediments to be polluted with arsenic and chromium. Some PAH contamination also exists within the bay. Sediments near the Western Lake Sanitary District outfall are contaminated with PCBs, arsenic, cadmium, chromium, copper, mercury, and lead. The St. Louis River site ranks on the National Priority List and is currently being investigated for Federal Superfund action. The St. Louis River/Bay is also an AOC. Development of a RAP for this area is in progress.	
New York (NO INFORMATION)	The State of New York has taken remedial actions involving sediments to alleviate water quality problems. Sediment removal has been used as part of lake restoration programs, and demonstration projects of alum additions to reduce phosphorus release from sediments have been completed.	

TABLE 6. SUMMARY OF STATE PROGRAMS AND ACTIVITIES RELATED TO CONTAMINATED SEDIMENTS (CONTINUED)

PROGRAM	CURRENT PROJECTS	PROPOSED PROJECTS
Ohio		
A State cleanup priority list was conceived to focus State attention on contaminated sites that were not addressed under Superfund. The proposed list was to be designed especially to focus on sites with long-term environmental threats, and therefore, do not rank high on the Federal Hazard Ranking System. Contaminated sediment sites fit this description.	Four AOCs exist in Ohio. All four are characterized by contaminated sediments. The development of the RAPs for all four areas is in the early stages. One of four Ohio AOCs is Ashtabula Harbor, which contains Fields Brook, a Superfund site. A remedial investigation/feasibility study has been prepared. The Fields Brook Record of Decision proposes to incinerate the most contaminated sediments and landfill those remaining. Rising costs and a number of other complications may preclude efforts to dredge the highly contaminated and toxic sediments in the river navigation channel. The river may be classified as a Superfund site or as an extension of the Field Brook Superfund site. A recent lawsuit settlement requires Bethlehem Steel to cleanup a stretch of the Black River, impacted by historical coke oven discharges, including phenolics and PAHs.	
Pennsylvania		
Under the Hazardous Sites Clean Up Act (Act 108) Pennsylvania Department of Environmental Resources has the authority to respond to the release of hazardous substances to the environment.	No current projects in the Great Lakes System.	No proposed projects in the Great Lakes System.

TABLE 6. SUMMARY OF STATE PROGRAMS AND ACTIVITIES RELATED TO CONTAMINATED SEDIMENTS (CONTINUED)

PROGRAM	CURRENT PROJECTS	PROPOSED PROJECTS
Wisconsin Under its Environmental Repair Program, Wisconsin has developed a State list and ranking process similar to the NPL. The criteria for this ranking system makes it unlikely that any contaminated sediment sites will be targeted for action.	The IJC has identified four AOCs in Wisconsin: 1) the Lower Fox River and Lower Green Bay, 2) the Menominee River, 3) the Milwaukee Harbor Estuary, and 4) the Lower Sheboygan River and Harbor. Contaminated sediments are a problem at all four sites. RAPs for all four are being developed by Wisconsin. An initial draft has been prepared for the Lower Fox River and Lower Green Bay. The RAP for the Lower Green Bay/Lower Fox River was signed by the Governor of Wisconsin as an amendment to Wisconsin's Water Quality Management Plan. In 1985, the Lower Sheboygan River and Harbor AOC was designated as a USEPA Superfund site. A major source of PCB contamination of fish and sediments has been identified as a landfilled dike. The contaminated soil from this dike was removed under State orders.	The potentially responsible party for the PCB contamination of the Lower Sheboygan River and Harbor will conduct the Remedial Investigation and Feasibility Study under the guidance of USEPA and the WDNR. Implementation is scheduled to begin in 1989 after completion of the feasibility study.

ANNEX 15: AIRBORNE TOXIC SUBSTANCES

INTRODUCTION

Although early studies indicated that measurable levels of phosphorus were contributed to the Great Lakes by air transport, giving rise in 1976 to the USEPA's Atmospheric Deposition Network, it has only been in the past decade that atmospheric deposition has been recognized as a significant source of contaminants to the Lakes, and perhaps the only source of some toxic chemicals found in the Upper Great Lakes where their presence is not attributable to either direct discharges or land runoff.

In 1981, the original Network mission was expanded from collecting data on airborne phosphorus loadings to Lake Erie to monitoring the deposition of a variety of pollutants into all the Great Lakes. Renamed the Great Lakes Atmospheric Deposition (GLAD) Network at this time, the project envisioned 36 U.S. monitoring sites representing industrial, agricultural, and urban sources of airborne contaminants around the Great Lakes.

The results of the GLAD Network and individual research projects in both the United States and Canada confirmed the atmosphere as a chief pathway of certain toxic chemicals to the Great Lakes. Recognizing the need for a fully coordinated, joint U.S. and Canadian program with compatible sampling and analytical protocols, two major workshops of experts were convened to assess the problem of atmospheric deposition and to assist in the design of an atmospheric research and monitoring program.

The first workshop, held in 1985, was sponsored by GLNPO and the University of Minnesota; the second, in 1986, by the IJC. Shortly thereafter, the IJC Surveillance Work Group established the Atmospheric Deposition Task Force to design a joint atmospheric research and monitoring network and to develop necessary protocols.

In 1986, the Governors of the Great Lakes States signed a Toxics Substances Control Agreement calling for cooperative action involving water discharge permits, accidental discharges, monitoring and surveillance, information exchange, fish consumption advisories, and atmospheric deposition.

Based upon an increased knowledge and concern about atmospheric deposition, provisions for addressing airborne toxic pollution were added to the Great Lakes Water Quality Agreement in 1987 (Annex 15). Annex 15 requires research, surveillance and monitoring, and implementation of pollution control measures to reduce atmospheric deposition of toxic pollutants to the Great Lakes Basin ecosystem. The Annex also requires the United States and Canada to report biennially on progress in implementing the Annex. In response to this and to the amendments to the Clean Water Act (CWA), the GLAD Network effort was expanded in FY 1988 to include sampling for airborne toxic organics.

With regard to regulatory programs under the Clean Air Act (CAA), USEPA began encouraging States to assess the scope and severity of air toxic exposures in 1986. USEPA's Air Program has provided States with grants for compiling emission inventories for certain source categories, investigating capabilities to model deposition patterns for toxic pollutants, and developing permit review procedures that explicitly consider air toxic impacts on the Great Lakes.

State air programs have made considerable progress in reducing conventional pollutant concentrations. Control of conventional air pollutants has indirectly resulted in substantial control of many air toxics. Attention has now turned to the more explicit control of air toxics. In FY 1988, USEPA Regions V and II were allocated $980,000 to support State air programs under CAA Section 105, focusing on the issue of toxic deposition. All eight Great Lakes States are coordinating emissions inventory procedures for air toxics and jointly developing permit guidelines to ensure that appropriate controls are placed on sources of air toxics. There are currently 609 regulated facilities in the counties of the Great Lakes area that are in compliance with all CAA requirements. Of the 26 facilities that are in violation, 7 are on compliance schedules.

Also in 1988, USEPA published a decision to regulate municipal waste combusters (MWCs) for dioxins, dibenzofurans, heavy metals, and other organics, such as PCBs under the authority of Section 111 of the CAA. The regulations will be based on the use of best demonstrated technology considering cost and other impacts. USEPA has issued interim operation guidance under the new source review requirements of the CAA that would effectively require emission limits for new MWC permits, thus substantially reducing the toxic components of MWC emissions. To control mercury emissions from other sources, USEPA has listed mercury as a hazardous air pollutant under Section 112 and has regulated mercury ore processing plants, chlor-alkali plants, and sewage sludge incinerators. Other pollutants regulated under Section 112 include arsenic, beryllium, asbestos, radionuclides, benzene, and vinyl chloride.

In addition to the GLAD Network and CAA regulatory programs, GLNPO coordinates data-gathering projects to address atmospheric deposition through the developing Green Bay Mass Balance Study and grant-funded urban toxic emissions inventories.

GREAT LAKES ATMOSPHERIC DEPOSITION NETWORK

The GLAD Network was originally established to determine atmospheric loadings of conventional contaminants, evaluate annual trends, and assess the results of various program strategies. In 1985, GLNPO enlisted the assistance of technical experts to evaluate the GLAD Network. The group concluded that: 1) the system was not adequate to provide data on airborne loadings of trace organics, 2) sites were not located on the basis of USEPA siting criteria, 3) there were potential problems in GLNPO's quality assurance/quality control program, and 4) there was a lack of coordination between Canada and the United States.

To remedy these deficiencies, new objectives for the GLAD Network were adopted, focusing on bioaccumulative pollutants found in Great Lakes fish. These pollutants include metals, pesticides, polynuclear aromatic hydrocarbons, and PCBs. In addition, recommendations were made to design a monitoring network that would combine deposition measurement and modeling to assess atmospheric deposition.

In October of 1986, three of the International Joint Commission boards -- the Science Advisory Board, the Great Lakes Water Quality Board, and the International Air Quality Board -- hosted a major international workshop on the GLAD Network. The purpose of the workshop was to reach a consensus among the participants on the nature of atmospheric loadings of 14 specific toxic chemicals to the Great Lakes Basin. The workshop findings demonstrated, first, the lack of knowledge on the atmospheric loadings of these chemicals, and second, the relative significance of these loadings compared to other sources. The resulting report estimated that 90 percent of the PCB loadings to Lake Superior are from the atmosphere. It also estimated that Lakes Superior, Michigan, and Huron receive over 90 percent of their lead input from the atmosphere. The report concluded with recommendations related to improving our ability to measure and predict atmospheric loadings.

As a result of these activities, two research and monitoring plans have been developed to address the deposition of air toxics to the Great Lakes. In 1987, GLNPO completed its proposed modification of the GLAD Network to include toxic organics. This plan calls for the establishment of five master stations across the Great Lakes to support necessary research on deposition and exchange processes, along with development of improved samplers. In addition, 12 routine GLAD Network stations are proposed, which will include sampling for toxic organics using currently available sampling equipment. Each station is to be equipped with wet precipitation collectors, high-volume samplers for collecting trace organics in the ambient air, snow gauges, wet/dry automatic precipitation collectors, high-volume samplers for collecting total suspended particulate and total organic carbon measurement, meteorological towers for collecting routine data, and other equipment.

Under a joint grant to the Illinois State Water Survey and DePaul University, GLNPO established the first master station and two routine stations on Green Bay in 1988 to begin deployment of the planned Network and to support the ongoing Green Bay Mass Balance Study. Each site is equipped with a 10-meter tower from which continuous measurements are taken on wind speed and direction, temperature, relative humidity, rainfall, and solar radiation.

GLNPO plans to set up routine stations and initiate monitoring programs for Lakes Huron and Erie in FY 1989. Master and routine stations for Lake Superior are scheduled for FY 1990, and for Lake Ontario in 1991.

The Great Lake States will continue to participate with GLNPO in operating the monitoring stations, and grants will be provided to universities for assistance with the stations and laboratory support for chemical analysis. As required by the Water Quality Agreement, GLNPO will also produce biennial reports on the implementation of this joint U.S. and Canadian air deposition network. Meanwhile, GLNPO continues to participate in planning discussions with Canadian and U.S. experts to further refine plans for enhancing the GLAD Network to achieve compatibility and concurrence with Canadian programs.

The second major research plan, completed by the IJC Atmospheric Deposition Task Force in 1988, is a Plan for Assessing Atmospheric Deposition to the Great Lakes. The IJC Plan submitted to the Water Quality Board with recommendation for inclusion in the Great Lakes International Surveillance Plan, calls for two master stations to be established over a 2-year period, followed by the phased establishment of routine stations as research results become available.

In December 1988, a committee was established to review the two plans, resolve remaining differences, and recommend a joint U.S. and Canadian research and monitoring plan on atmospheric deposition. The joint plan should be completed by June 1989. Currently, three ad hoc committees of experts are detailing plans for quality assurance/quality control procedures, analytical methods, sampler design, and siting criteria to be used in the deployment of the joint network.

GREEN BAY MASS BALANCE STUDY

Traditionally, water quality management focused on control of direct discharges of pollutants to surface waters. Such point sources were the easiest to identify, characterize, and control. In many cases, however, their control did not solve water quality problems. Recognizing that pollutants are also introduced by contaminated air, soil, sediments, and ground water, the management approach to Great Lakes water quality had to be reassessed. This reassessment led to the initiation of a "mass balance" approach, in which the total contributions of pollutants from all sources are estimated and analyzed.

GLNPO, in conjunction with the Wisconsin Department of Natural Resources, the National Oceanic and Atmospheric Administration, and EPA's Office of Research and Development is conducting a mass balance pilot study for toxics in a mid-sized ecosystem, prior to expanding this effort to whole-lake situations. In Green Bay (the chosen site for study), a modeling framework is being developed and tested to provide greater understanding of the sources (including atmospheric sources), transport, and fate of toxic substances and to ultimately guide and support regulatory activity. The models will be capable of alerting managers to the presence of currently unidentified pollutant sources, of describing the relative significance of the sources, and of predicting the response of the ecosystem to proposed regulatory actions involving a single source or a combination of sources.

AIR TOXICS EMISSION INVENTORIES

In FY 1988, GLNPO also began work to fulfill Annex 15 requirements to inventory toxic emissions in the Great Lakes Basin. There are three major projects recently completed or ongoing in the Great Lakes Basin that contribute to this effort. The first is the Air Toxic Emission Inventory for Southeast Chicago, the first phase of which attempted to estimate the emissions rates of a wide variety of inorganic and organic pollutants in a well-defined, highly industrialized geographic area of the shores of Lake Michigan. In the second phase, mathematical modeling will relate emissions rates to concentrations at ground level and the corresponding health risks to exposed humans.

The second project is the Emissions Inventory and Deposition Modeling of Air Toxics in the Lake Michigan Region, now underway. Once air source data from the major metropolitan areas are collected, USEPA will attempt to model deposition of toxic pollutants to the Lake Michigan watershed and directly to the Lake to estimate total atmospheric deposition loadings from near-field sources in the Lake Michigan airshed.

The third project, the Great Lakes Air Toxics Transboundary Project, focuses on sources located in a 50-kilometer-wide corridor on either side of the shores of the Detroit River and St. Clair River systems, including the Detroit/Windsor and Port Huron/Sarnia urban/industrial centers. The project includes an emissions inventory, dispersion modeling, human risk assessment, and deposition analysis of pollutants of concern in the watershed basin.

These projects involve the cooperation of GLNPO, the EPA Region V Air Program, and local governments. Together, they should considerably increase USEPA's understanding of the significance of air deposition to the water quality of the Great Lakes and their connecting channels.

Future efforts in the area of atmospheric deposition of toxic materials include GLNPO's plan to work with USEPA's Air Program to complete an emission inventory for air toxics to the Great Lakes, and to support initiatives for State toxic programs and for monitoring results. Ultimately, if regulatory or other controls are necessary to meet the goals of the Great Lakes Water Quality Agreement, recommendations will be developed.

ANNEX 16: POLLUTION FROM CONTAMINATED GROUND WATER

INTRODUCTION

Determining the magnitude, distribution, and impact of contaminated ground water of the Great Lakes Basin is the subject of Annex 16. In support of this overall goal, responsible State and Provincial environmental agencies must first identify existing and potential sources of contaminated ground water to the Great Lakes. To identify sources, each nation must map the regional hydrogeologic conditions in the vicinity of significant contamination sources to determine the probable and potential extent of pollution. Next, a standard approach and procedures for sampling and analysis of the contaminants in the ground water must be developed. Implementation of standard sampling and analysis programs will enable the Parties to quantify the extent of contamination and accurately estimate contaminant loadings to the Great Lakes to support development of Remedial Action Plans (RAPs) and Lakewide Management Plans (LMPs). The Parties must report by December 31, 1988, and biennially thereafter, on progress in controlling sources of groundwater contamination and preventing movement of polluted ground water to the boundary waters of the Great Lakes.

In this first progress report, numerous U.S. Agencies commented on activities conducted in FY 1988 and, in some cases beyond this year, in support of the goals of Annex 16. Under Federal statutory authorities such as the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA), the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act (RCRA), the Hazardous and Solid Waste Amendments, and the Safe Drinking Water Act, or in conjunction with existing programs for monitoring and protecting groundwater resources, these agencies have made advances in protecting the Great Lakes from contaminated ground water.

Significant progress has been made toward controlling and remedying uncontrolled hazardous waste sites and toward ensuring that active hazardous waste management facilities are operated in accordance with Federal and State regulations. States are developing proposals for wellhead protection grants and have begun conducting pilot projects to demonstrate protection strategies. Much has also been accomplished in researching the significance and effects of groundwater contributions to Great Lakes contamination. The major activities and accomplishments in these areas are discussed in this section.

U.S. ENVIRONMENTAL PROTECTION AGENCY ACTIVITIES

Groundwater Protection Strategies

In 1984, USEPA initiated a National Groundwater Protection Strategy. This strategy consisted of four principal elements:

- Strengthening the capacity of State governments to protect groundwater quality
- Addressing groundwater contamination sources of particular national concern
- Establishing a groundwater classification system to guide USEPA policies
- Coordinating the development and implementation of groundwater protection policies at the Federal, Regional, and State levels.

Since 1984, various States, including those in the Great Lakes Basin, have developed their own State groundwater protection strategies that are tailored to their existing regulatory programs and that focus on their specific groundwater quality issues. USEPA Regional strategies have been developed to promote and assist the States in implementing their strategies and to bridge the gap between the broadly focused national strategy and the very specific State strategies.

The Region V Groundwater Strategy, adopted in May of 1988, was developed as a vehicle for unifying groundwater initiatives underway in the Region. The Strategy highlights those groundwater objectives that require more than a single contaminant source perspective, and provides a proactive method for achieving objectives given the legislative and fiscal constraints of individual programs. The Strategy has three principal parts: a set of groundwater goals, a set of Regional groundwater objectives and general implementation steps necessary to attain those objectives, and a process for conducting an annual review of Strategy-related activities.

Geographic Information Systems (GIS) will be an important tool for implementation of the Strategy. During FY 1989, Region V will form a work group to begin developing a GIS for the Region with capabilities applicable to implementing RAPs in Areas of Concern (AOCs), managing wellhead protection areas, monitoring and evaluating area-wide use of agricultural chemicals, and assessing wetlands and other surface waters affected by groundwater contamination.

The Great Lakes National Program Office

GLNPO dedicated resources this year to the development of strategies to accomplish each of the goals of Annex 16 and charted a 5-year strategy to ensure completion of these goals. Recognizing that groundwater research strategies are always evolving in this relatively early stage of study, GLNPO committed substantial resources to train staff in using GIS to fulfill the Annex 16 requirement to inventory and map hydrogeological conditions of the Great Lakes. In conjunction with this technical training, the Office is planning strategies to identify existing and potential groundwater contamination sources. GLNPO staff will assume an important role in establishing a Regional GIS for Region V under the Region's Groundwater Strategy.

In addition, GLNPO submitted a series of proposals for site-specific exploration. GLNPO will participate in a study in the Ashtabula, Ohio, area to characterize pollutant sources and exposure pathways by implementing the Multimedia Environmental Assessment Tracking System (MEATS) in conjunction with a standard GIS. The MEATS monitors environmental data in a regulatory context and will enable GLNPO to generate reports on compliance schedules and other regulatory requirements for industries discharging pollutants in the Great Lakes Basin.

GLNPO has outlined several goals for the Ashtabula project. The project will offer program staff the opportunity to gain expertise in GIS map production techniques and encourage the development of standard GIS applications, programs, and models for environmental assessments in a geographic setting. The project will also identify cross-media issues and areas where regulatory actions are necessary. Finally, the Ashtabula project will increase coordination among regulatory programs and subsequently integrate planning efforts within existing regulatory and organizational frameworks.

A second site-specific project with a significant groundwater component, the Green Bay Mass Balance, will include compiling a comprehensive inventory of known and potential sources of groundwater contamination in the Green Bay Basin. By using geophysical/hydrological techniques to determine the groundwater flux on a continuous basis, GLNPO will identify the sources, pathways, and fate of key indicator toxic chemicals into and through the Green Bay. In addition, staff will analyze data derived from groundwater discharge maps to define priority groundwater areas. These activities will further the goal of improving permitting and enforcement decisions for waste sites by compiling maps to reflect hydrogeological information and contamination sources.

To support the Green Bay Mass Balance and other important initiatives related to the GLWQA, GLNPO has and continues to support important research initiatives related to the significance of groundwater contamination for Great Lakes water quality. For example, the Office is presently funding a grant to the University of Wisconsin for research on groundwater intrusion monitoring techniques. The results of this research will have important implications for the Green Bay project. The Green Bay Mass Balance study plan includes a number of initiatives related to estimating and measuring rates of groundwater intrusion; work in this area is expected to continue.

GLNPO is also funding groundwater research to assist with RAPs. Presently, GLNPO is providing funds to the State of Indiana for development of a RAP in the Grand Calumet River AOC, where contaminated ground water may be an important source of toxic pollutants. At the Grand Calumet site, the State and the U.S. Geological Survey (USGS) are collaborating on a project to describe the hydrogeologic characteristics underlying the region. This effort will allow scientists to predict how contaminants from the heavily industrialized region migrate from the site and whether they are an important source of toxic pollution to the Indiana Harbor.

In FY 1989, GLNPO continues to work with the Region V program divisions to assemble and map the inventory of known and potential sources of groundwater contamination in the Great Lakes Basin. During FY 1989, GLNPO will also develop pilot GIS projects for wetlands in the Great Lakes Basin, the Green Bay Mass Balance Study, and the Ashtabula RAP.

USEPA has made considerable progress during FY 1988 toward addressing groundwater contamination in the Great Lakes Basin. In support of Annex 16, paragraph (iv), the Agency's hazardous waste programs implemented under RCRA and under CERCLA have continued to address both active and inactive hazardous waste sites, one of the principal sources of contaminated groundwater in the Great Lakes Basin and throughout the United States. Additionally, USEPA is now implementing a Wellhead Protection Program, as mandated by the 1986 amendments to the Safe Drinking Water Act, and Groundwater Protection Strategies are being developed and implemented at the USEPA Regional level and within the Great Lakes States.

Under RCRA, USEPA and the States have continued to issue permits for active hazardous waste treatment, storage, and disposal facilities in the Basin, and have begun to implement the corrective action program mandated by the 1984 amendments to RCRA. This program will ensure that all existing environmental contamination at active facilities is remedied as a condition of State or Federal permits. In addition, during FY 1988, USEPA began promulgating regulations that restrict certain hazardous waste from land disposal. This program, together with minimum technology standards for land fills and surface impoundments, which became effective this year, provide considerable protection against future groundwater contamination caused by placement of hazardous waste on the land. Also in FY 1988, EPA began reviewing its present guidelines for municipal and industrial solid waste disposal facilities. The Agency is now embarking on an effort to develop and promulgate more stringent guidelines for these facilities.

Under CERCLA, USEPA regional programs and State environmental agencies have continued to identify, characterize, and address abandoned hazardous materials dumpsites in the Great Lakes Basin. In addition, States have taken initiatives to address their own priorities for cleanup.

Specific accomplishments by USEPA regional programs and GLNPO in these and other areas are presented in the following discussion.

Regional RCRA Programs

In USEPA's Region V (comprising six of the eight Great Lakes States), there are nearly 1,000 companies that treat, store, or dispose of hazardous waste. In FY 1987, Region V and the States inspected more than 1,700 facilities and initiated more than 1,000 enforcement actions in response to violations. During FY 1988, Region V and the States continued to issue operating permits to active hazardous waste management facilities and to conduct an aggressive enforcement and compliance monitoring program. Future activities in the Region and at the State level will focus increasingly on the problems of solid waste disposal and leaking underground storage tanks.

USEPA's Region II and Region III offices, together with the States of New York and Pennsylvania, have made similar progress toward implementing Great Lakes groundwater protection programs under RCRA and RCRA's Hazardous and Solid Waste Amendments (HSWA). USEPA estimates that nearly 26,000 RCRA permittees and permit applicants are located within the counties of the Great Lakes Basin. New program provisions implemented under HSWA will ensure that these facilities are fully evaluated and that all existing contamination is remedied as part of the permit issuance process.

Regional CERCLA Programs

Similar progress has been made to address uncontrolled hazardous waste sites in the Great Lakes Basin. By 1988, USEPA's Region V had identified over 5,300 sites within its jurisdiction. Presently, there are 228 Region V sites on the National Priorities List (NPL), more than any other area of the country. As of the end of September, 1988, Region V had completed preliminary assessments at 4,730 sites and site inspections at 1,310 sites.

The Region conducts both long-term cleanup actions and emergency removal actions under CERCLA. In FY 1987, Region V completed 8 removal actions at sites not listed on the NPL and 24 at sites listed on the NPL. Long-term cleanups have begun at nearly 150 sites within Region V. These actions may be conducted by the Region or under Consent Decree with the responsible parties.

USEPA Regions II and III operate similar programs for cleanup of uncontrolled hazardous waste sites that affect potential sources of groundwater contamination in the Great Lakes Basin. In addition to the Federal programs, the States of Michigan, New York, Ohio, and Minnesota have created their own State Superfunds to address sites that are not eligible for the Federal NPL, but are important State cleanup priorities.

U.S. GEOLOGICAL SURVEY ACTIVITIES IN THE GREAT LAKES BASIN

The USGS recently completed a 2-year study in cooperation with Canada on environmental conditions in the Upper Great Lakes Connecting Channels (UGLCC). This study includes a groundwater component and is part of an effort to study water quality problems on a regional basis within the Great Lakes Basin. A similar study was completed several years ago on the Niagara River in conjunction with the State of New York. Both of these studies involved characterizing the significance of nonpoint sources of pollution, including pollution from contaminated ground water.

The objective of the groundwater component of the USGS study was to determine groundwater loadings into the UGLCC. In its preliminary administrative report, USGS recommends greatly increasing extensive investigation into groundwater conditions in the Detroit area. The development of a flow model would facilitate collection of water quality information. The USGS made a preliminary finding that the deep injection of billions of gallons of hazardous waste on the Canadian side of the connecting channels is causing brines to flow into U.S. wells. The USGS also recommended that the Port Huron and St. Clair River areas in Michigan be investigated further, and has submitted a request to USEPA Region V for additional funding to continue research efforts on groundwater contamination in the UGLCC.

WELLHEAD PROTECTION ACTIVITIES

The 1986 Amendments to the Safe Drinking Water Act (SDWA) established a new Wellhead Protection (WHP) Programs to protect ground waters that supply wells and wellfields that contribute drinking water to public water supply systems. Under SDWA Section 1428, each State must prepare a WHP Program and submit it to EPA by June 19, 1989. A comprehensive WHP Program comprises several distinct and essential elements. At a minimum, each State's WHP Program must:

- specify roles and duties of agencies
- delineate wellhead protection areas
- identify sources of contaminants
- describe management approaches
- describe contingency plans for well closures
- site new wells properly
- ensure public participation.

Of the eight Great Lakes States, Indiana, Ohio and New York are proposing to submit wellhead protection programs to USEPA by June 19, 1989.

The State of Illinois has developed a sophisticated wellhead protection approach. The State Legislature recently passed the Illinois Ground Water Protection Act that requires the establishment of setback zones around public water supply wells. These zones are currently being delineated by the State according to a specified schedule and consistent with the particular hydrogeological conditions of each area. The Act also places restrictions on land use in relation to wellhead areas.

The States of Minnesota, Wisconsin, Indiana, and Ohio have also initiated some preliminary wellhead protection projects. Pilot protection programs are underway in Minnesota and Wisconsin. The State of Indiana has funded a program for development activities on site-specific wellhead protection projects, and the State of Ohio has commenced a project to identify methods for delineating wellhead protection areas in two major hydrogeologic regions of the State.

The State of Michigan has delegated authority for wellhead protection programs to both the Michigan Department of Natural Resources and the State Department of Public Health. These agencies will collaborate to develop a wellhead protection program in the future. A task force will work during FY 1989 to generate consensus regarding the State's wellhead protection program. Michigan also has an extensive groundwater contamination site inventory and has initiated a number of groundwater cleanup activities under the State's Water Resources Commission Act of 1929 and the State Superfund Program.

In Region II, New York State has committed to submitting a wellhead protection program for the June 19, 1989, deadline as required by SDWA. This program will explain the State's approach to devising its program, including the option to phase-in various programs currently under review as potential components of the overall program.

Regardless of the program strategy, New York has decided to use existing regulations and to increase enforcement capabilities. Details on the specific strategy to delineate wellhead areas are yet to be finalized, however, current thinking favors the "fixed radius approach," (i.e., a specified distance around a public water supply well). The State will also address the importance of land use issues with respect to groundwater protection programs. As land use remains a local issue, New York recognizes that a major part of the strategy will focus on involving local authorities in program development.

In some areas of New York, wellhead protection activities are already underway, funded by the Clean Water Act, Section 205(j). For example, Suffolk County's water supplier is initiating a wellhead protection program on its own, and EPA Region II is encouraging county officials to participate. If this program is successful, it may be extended to Nassau County. The program uses existing regulations and strengthens enforcement provisions. Officials are also distributing educational materials to the public, conducting audits, and establishing inventories of industrial facilities. In addition, Section 205(j) money has been allocated to three local planning agencies (Herkimer-Oneida Regional Planning Board, Southern Tier West Regional Planning Board and the Tug Hill Aquifer Commission) in upstate New York for mapping sources of contamination.

SPECIAL REPORT TO THE INTERNATIONAL JOINT COMMISSION ON POINT SOURCE CONTROLS

INTRODUCTION

Much progress has been made in controlling point sources to the Great Lakes system. Direct discharges to the Great Lakes system in the United States are regulated by nearly 3,675 discharge permits for industry and municipal sewage treatment facilities, issued as part of the National Pollutant Discharge Elimination System (NPDES) under Section 402 of the Clean Water Act (CWA). Through 1986, $7.9 billion in Federal and State grants had been invested in the Great Lakes Basin for municipal sewage treatment works. In 1985, more than 95 percent of the population in the Great Lakes States of USEPA's Region V (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) was served by municipal sewage treatment facilities and 99 percent of the sanitary wastes in sewered areas received at least secondary treatment.

Among the most significant achievements to date in the Great Lakes regarding point source controls is the reduction of phosphorus discharges from point sources. Special treatment for phosphorus removal was provided for 79 percent of all sewage handled in sewered areas during 1985, and 163 of 187 major municipal sewage treatment facilities complied with the 1 milligram per liter (1 mg/l) effluent limit for phosphorus set by the GLWQA. Advanced wastewater treatment was provided in 1985 by 15 percent of all treatment facilities, and 8 percent provided high-level nitrogen control. The most recent data on phosphorus discharges from point sources show that since 1972, the United States has achieved a reduction of phosphorus of approximately 80 percent.

In other areas, the commitment to identify Point Source Impact Zones and reduce their size and effect is also an important aspect of attaining the GLWQA objectives. The first report on Point Source Impact Zones is due September 30, 1989. USEPA is currently working with the Great Lakes States to establish consistent definitions and methods of reporting.

Although the GLWQA does not expressly call for a report on point sources, the United States considers it important to report on activities and progress regarding two point source areas: activities related to controlling stormwater impacts from both separate and combined sewers and efforts directed at controlling toxic chemicals from point sources. These efforts include implementation of Section 304(l) of the CWA and State water quality-based control programs such as Michigan's Rule 1057.

COMBINED SEWER OVERFLOW STRATEGY

Combined sewer overflows (CSOs) are considered point sources, and must meet the permit requirements of the NPDES. In the process of writing permits for CSOs, Regions and States must conduct system-wide evaluations and set priorities by estimating such factors as flow, frequency, duration, and pollutant loadings to rank publicly-owned treatment works (POTWs) collection systems and CSO discharge points. The permits must contain compliance dates as listed in Section 301 and Section 304 of the CWA for those CSOs discharging toxic substances. Permits must allow for monitoring of CSOs to determine whether facility modifications or system improvements are necessary and to ensure that best management practices are used at a particular facility.

Other control measures that should be explored by municipalities for controlling discharges from CSOs are improved operation and maintenance, a system-wide stormwater management program, pretreatment program modifications, pollutant-specific limitations, compliance schedules, flow minimization and hydraulic improvements, sewer ordinances, identification and elimination of illegal discharges, local limits program modifications, and construction of CSO controls within the sewer system and/or new and modified wastewater treatment facilities.

STORM WATER PERMITTING IN THE ROUGE RIVER

Under the terms of the Clean Water Act, storm water is considered a point source. Under the 1987 amendments to the CWA, industries discharging storm water must apply for a permit and must equip storm drains with BAT or BCT. Municipalities serving more than 100,000 people must decrease discharges from storm drains to the maximum extent possible. While the other sized communities are also affected, permitting requirements are phased with largest communities first to comply. Regulations on issuing stormwater permits as required by these provisions are expected in 1990.

Michigan's Rouge River Basin is an example of a recognized Area of Concern that could benefit from more restrictive stormwater permitting requirements. The amendments to the CWA gave the USEPA firm statutory authority to require permits for storm drains discharging to the Rouge River, whereas regulations concerning such discharges prior to these amendments were not specific as to the authority governing stormwater runoff. The Michigan Department of Natural Resources (DNR) estimates that pollutant loadings to the Rouge River from point and nonpoint source discharges were 473 million pounds in 1987. Although CSO and stormwater runoff represent less than half of this amount, such discharges are most likely to impair water quality. Stormwater runoff alone accounts for two-thirds of the lead discharged to the Rouge River, as well as conventional and nonconventional pollutants.

State officials are currently identifying all industrial and municipal storm drains that discharge pollutants to the Rouge River. So far, 273 have been identified that need permits, but officials suspect that there are many more that must be regulated and monitored. Industrial permit applicants are required to submit maps of onsite drainage, management practices and control measures, and test data on various pollutants and other discharges. Municipal permit applicants must provide information on dischargers including source, amount, and type of discharge.

USEPA and Michigan DNR issued a draft remedial action plan in June 1988 for the Rouge River Basin and recommended a series of actions to address the pollution problems associated with discharges from storm drains including eliminating illegal connections to storm drains, issuing permit for stormwater discharge in 1990, reviewing and updating local stormwater management programs, and when necessary, building retention basins to reduce discharges to the river. This prototype plan will serve as a model for similar efforts in the Great Lakes Basin.

STORMWATER REPORT TO CONGRESS

USEPA is required by the amendments to the CWA to submit two reports to Congress to identify stormwater discharge sources, determine the nature and extent of pollution from those identified, and establish procedures and methods to control such discharges. USEPA must promulgate regulations, establishing application requirements for industrial and stormwater systems serving large cities. In addition, smaller cities, other jurisdictions, and commercial point sources will be studied to assess stormwater discharge status.

The reports to Congress will discuss the regulatory and environmental background of the stormwater program with regard to the NPDES, CSOs, nonpoint source strategies, and State and local programs. In addition, USEPA will identify moratorium sources for stormwater discharges.

SECTION 304(l) OF THE CLEAN WATER ACT

The CWA, as amended, provides an accelerated timetable within which USEPA and the States are required to assess and target impaired surface waters for action to bring these waters into attainment of applicable water quality standards. Section 304(l) imposes important new statutory requirements on the ongoing national program for pollutant control by requiring States to identify waters that are not expected to meet water quality standards after dischargers have met current cleanup requirements. Section 304(l) requires increased activity in addressing known water quality problems by requiring States to develop lists of impaired waters, identify point sources and the quantity of pollutants they discharge that cause adverse impacts, and develop individual control strategies for each such point source.

Regions and States have submitted preliminary lists of impaired waters to USEPA. USEPA's Water (Management) Divisions in Regions II, III, and V (along with the Environmental Sciences Division in Region V) are now reviewing lists submitted by the Great Lakes States. Individual control strategies must be designed to reduce discharges to listed waters and bring water quality into compliance through final, enforceable NPDES permits and water quality standards by the statutory deadline.

USEPA will assist States in routinely updating and refining procedures for implementing point and nonpoint source controls by publishing criteria and advisories on additional pollutants of concern (in addition to the CWA Section 307(a) toxic pollutants); providing supplemental guidance on improved biological monitoring, assessment, and evaluation techniques for complex point and nonpoint source discharges; publishing national technical guidance on sampling, modeling, and procedures for calculating total maximum daily loads and waste load allocations; and developing risk assessment/risk management procedures to define program priorities for the national program for toxics control.

IMPLEMENTING WATER QUALITY-BASED POINT SOURCE EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES

Water Quality Standards (WQSs) for lakes and streams set the maximum concentration for substances that must be attained in ambient waters. As noted in the previous section, they are an essential basis for the section 304(l) process addressing toxic substances. To meet the requirements of section 303(c)(2)(B) of the Clean Water Act, each State must adopt numeric water quality criteria for all section 307(a) toxic pollutants for which EPA has published criteria under section 304(a) and the discharge or the presence of which could reasonably be expected to interfere with designated uses of the effected waters. Although numeric criteria are to be adopted, a State may meet this requirement by adopting a narrative standard and a translator procedure to be used to derive numeric criteria. Either numeric or narrative criteria must be adopted for any pollutant. Criteria must be adopted for protection of both human health and aquatic life. Also, criteria may be adjusted on a site-specific basis to reflect changes in water chemistry on the ability of local species to adapt. Standards are enforced through NPDES permits and permit limits may be derived based on either numeric or narrative standards. One means used to implement a narrative toxic standard is whole effluent toxicity testing.

New York has adopted numerical WQS while Michigan has adopted narrative standards. New York was immediately sued by the private sector upon promulgation of its WQS, but prevailed in court. Michigan has not been sued, nor has Michigan had to sue to enforce its authority to impose water quality-based effluent limitation calculated according to Rule 1057 in its NPDES permits. Ohio, Wisconsin, and Minnesota have adopted or are in the process of adopting an approach similar to Rule 1057. During its triennial review of its WQS, Michigan is now contemplating revisions to Rule 1057 to allow it to derive enforceable numerical ambient WQC as required by the 1987 amendments to the CWA.

The most controversial portion of Rule 1057 has been its regulation of carcinogens. For those substances causing cancer in laboratory animals, humans, or both, Rule 1057 provides that exposure to humans resulting from body contact, recreation, and fish consumption shall not result in a cancer risk exceeding one-in-one hundred thousand (10^{-5})for a 70 kg adult exposed continuously for a 70-year lifetime. Michigan is the first state to propose an acceptable cancer risk threshold for its surface waters. New York has adopted a 10^{-6} design acceptable cancer risk in deriving its numerical WQS for carcinogens (other than those for which Federal Drug Administration action levels have been promulgated). Both Michigan and New York calculate risk on a chemical-by-chemical basis, while USEPA recommends adding the cancer risks of individual carcinogens to estimate the aggregate risk. Minnesota has adopted USEPA's approach.

PRETREATMENT

Authorized by Section 307 of the CWA, the National Pretreatment Program is designed to regulate non-domestic wastewater contributions to POTWs. The General Pretreatment Regulations (40 CFR 403) promulgated on June 26, 1978, established the administrative framework for the program and identified the roles and responsibilities necessary to achieve the CWA goals.

Since 1978, the General Pretreatment Regulations have been the focus of numerous legal challenges and amendments. The amendments have expanded and clarified the requirements included in the regulation. Most recently the regulations were amended on October 17, 1988, to incorporate changes recommended by the Pretreatment Implementation Review Task Force.

Concurrent with USEPA efforts to develop the General Pretreatment Regulations, the Agency has worked toward the full promulgation of National Categorical Pretreatment Standards. These standards establish technology-based control for specific industrial categories known to discharge significant pollutant quantities to POTWs. In addition to these Federal standards and requirements, POTWs are expected to develop more stringent or supplemental "local limits" as necessary to ensure the integrity of the POTW treatment works and its sludge disposal practices, with NPDES-approved States exercising program oversight as "Approval Authorities." The local POTW programs act as "Control Authorities" in imposing Federal, State, and local standards and requirements on their contributing industries.

In the Great Lakes States, a total of 476 POTWs are subject to these pretreatment requirements. (Of this total, 222 POTWs have effluent flows greater than 5 million gallons per day.) The program approval rate within the Great Lakes States has been better than the national average. There are 33 approved pretreatment control authorities in New York State counties containing areas that drain into the Great Lakes area. A total of 466 facilities, or 97.9 percent of those POTWs subject to the new requirements received program approval by September 30, 1988.

Efforts are currently underway to delegate administration of the CWA Pretreatment Program to the States. As of September 30, 1988, four Great Lakes States have received approval for State Administration, and three other States have been active in Pretreatment Program Implementation, although program administration has not yet been officially delegated. (Nationwide, 25 of the 39 NPDES States and territories had received delegation of the Pretreatment Program.)

NATIONAL MUNICIPAL POLICY

The CWA required that by July 1, 1988, POTWs meet NPDES permit effluent limits based on secondary treatment or any more stringent limit necessary to meet water quality standards. Because of historic problems with municipal compliance, the Agency developed the National Municipal Policy (NMP) in January 1984, which places renewed emphasis on improving municipal compliance rates in order to protect the Nation's water quality. The NMP establishes enforcement priorities for facilities that are unlikely to meet the July 1, 1988 deadline.

As of July 27, 1988, 87 percent of Region V's major POTWs have met the requirements of the NMP. Ninety percent of the Region's minor facilities are also in compliance, compared to 77 percent prior to NMP enactment. As a result, 95 percent of the total sewage processed in the United States receives at least secondary treatment. Voluntary compliance and Federal and State enforcement are responsible for achieving the compliance record. Of the 13 percent of POTWs that did not achieve compliance, most are on enforceable timetables leading to compliance or litigation. USEPA Region V or the States have court actions pending against 62 large cities that have failed to meet the NMP and have placed 29 city plants on court-ordered compliance schedules.

DEMONSTRATION PROJECTS

Demonstration projects for addressing point sources of pollution on the Great Lakes have concentrated on controlling conventional pollutants and reducing eutrophication. GLNPO has participated in evaluating and demonstrating techniques for phosphorus uptake from sewage, anaerobic oxidation phosphorus removal techniques, and in-line storm flow control devices. Each of these has shown potential for reducing discharges of phosphorus and other pollutants to the Lakes at a lower cost.

In future years, Great Lakes programs for point sources will focus on controlling discharges of toxic pollutants. During the next 2 years, several important new programs for controlling point source discharges of toxic pollutants will be developed and implemented under the CWA, including programs under Section 304(l), discussed earlier. In FY 1989, GLNPO will begin developing a process for addressing Point Source Impact Zones in the Great Lakes, as required by the GLWQA, and will continue to work toward development of Lakewide Management Plans. These programs will require new or improved biological and chemical monitoring techniques and new regulatory approaches that will be the subjects of future Great Lakes demonstration projects.

MONITORING DATA FOR TOXIC LOADINGS FROM POINT SOURCES

Existing information on toxic pollutants of concern in wastewater discharges within the Great Lakes system is still too scant for accurate estimates of point source load contributions to each of the Great Lakes. Some permits require routine toxicity testing of effluents, involving tests such as bioassays. While these tests are carried out by the permittee, results are shared with State and Federal agencies. Surveys to assess compliance with permit limitations are also conducted by regulatory agencies.

Permittee self-monitoring data are stored in a computer information system known as the Permit Compliance System. The results of Federal or State agency compliance inspection monitoring and select self-monitoring data are also contained in STORET, USEPA's general water, sediment, and biota quality data base. Permittee and agency whole effluent toxicity test results are summarized in the CETIS data base.

To analyze the contributions of persistent toxic pollutants by point sources, GLNPO has supported the development of a national data base of monitoring data from Form 2c NPDES permit applications. In addition, USEPA Region V and GLNPO have supported the Michigan DNR with a 205(j) grant to update and expand its Critical Materials Register, a list of toxic substances meriting State surveillance. Each year, Michigan facilities are required to report the production or use, discharge, and disposal in solid residuals of Critical Materials. These data are compiled in a computer data base developed under a Toxic Substances Control Act grant to Michigan from USEPA. Total loadings of Great Lakes pollutants of concern can be compiled on an individual facility, river, or lakewide basis. GLNPO is using these loading estimates as part of a larger effort to calculate total loadings of persistent toxicants to the Great Lakes from all sources.